

Caboolture River Steel Bridge

April 1996

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

Steel bridges in the Sun

Caboolture River pedestrian and bikeway bridge



Durable structural steel provided the answer for Caboolture Shire Council in the design of a new pedestrian/bikeway bridge over the Caboolture River. Caboolture Shire is one of Australia's fastest growing regions and rapid population growth has created demand for new transport infrastructure. The new bridge provides a vital link between Norfolk Esplanade in the suburb of Bellmere on the south side of the river, and Riverview Street which borders the picturesque Centenary Lakes Park and intersects King Street, the main street through the town centre.

The Caboolture Shire Council let a design and construct contract for the bridge and selected the bridge type on the basis of aesthetics, initial cost and future maintenance costs.

The successful bidder was JF Hull Holdings Pty Ltd, with engineering design being carried out by Consulting Engineer, Benard-Connolly & Partners. Ed Benard of Benard-Connolly opted for a cable-stayed bridge with a centre span of 55m and an approach span each side of 22m giving an overall bridge length between abutments of 99m (see Fig 1). It is designed for a live load of 5 kPa in accordance with the AUSTRROADS 1992 Bridge Design Code and Australian Standard AS1428 - Design for Access and Mobility. Vibration considerations were an important part of the design and damping, in the range of 2.5-3%

The trussed steel bridge deck and tubular steel 'A' frame tower solution met the

essential criteria of:

- lightweight construction
- economy (in particular, the long spanning ability of steel minimised costly pier construction in water)
- aesthetics
- minimisation of on-site work
- erection from the bank.

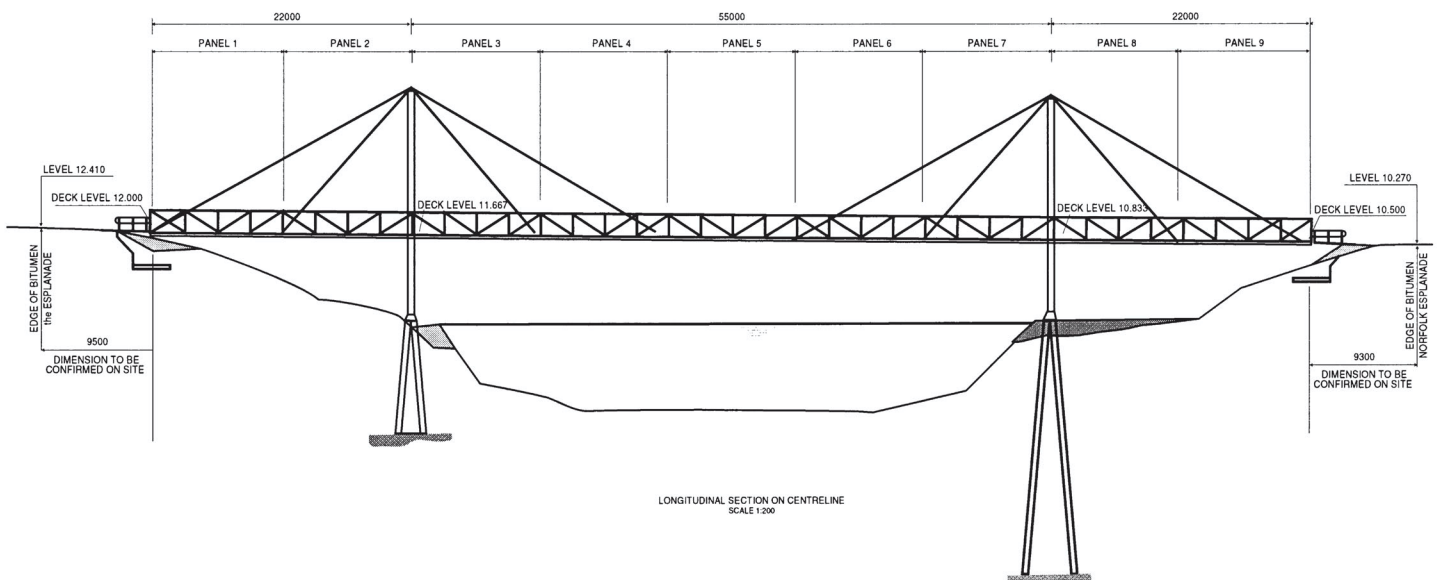
Structure

The two "A" frame towers, each approximately 18m high above concrete pier level and 5.4m apart at the base, comprise 2 No 508 OD x 6.4 CHS (Grade 250) inclined legs connected at the top by a 1400mm long x 600mm wide x 20mm thick cap plate. The joint is further stiffened by two vertical plates, each 1000mm deep x 100mm max width x 12mm thick, which are bolted to a 125TFC which is, in turn, welded to the outer face of each tower leg. A 20mm thick top plate assembly, stiffened with 16mm thick vertical plates, is bolted to the frame cap plate with 14 No M24 8.8/S bolts. The top assembly supports eight high strength steel stays.

The tower legs are also tied by a 1.1m deep 'K' brace system comprising a 150UC37 top chord and 100x100x4.0 SHS bottom chord and diagonal web members, with the top chord being located at a point 6.5m above concrete pier level. Each tower leg has a 670mm dia baseplate which is attached to the concrete pier with 8 No. M24 bolts. The 508 OD tube leg is spliced at the mid height position with 20mm thick plates and 8 No. 8.8/S bolts.

The bridge deck consists of 90mm thick precast concrete units spanning 2.75m across the deck and supported on 50x50x5.0 EA

Figure 1 Longitudinal Section



Machine State

(Equal Angle) seating lugs connected to the side trusses at 600 centres. 200UB25 cross beams also span between the 1.5m deep vertical steel trusses which in turn are suspended from the towers by 30mm dia VSL "CTS" bars attached to the truss bottom chords at 11m centres. Each vertical truss comprises 100x100x4.0 SHS top and bottom chord members, 100x50x3.0 RHS vertical web members at 2.75m centres and steel angle diagonal web members. Lateral stability of the deck structure is provided by 50x50x5.0 EA horizontal cross bracing beneath the slab (100x100x4.0 SHS diagonals at each end panel adjacent to abutment) and a 150x150x6.0 SHS spine member.

The northern abutment (Riverview St) has shallow rock at 5.6m below the surface whilst the southern abutment (Norfolk Esplanade) has deep rock at 17.6m below the surface. The concrete pier headstocks are supported on four precast concrete raking piles.

Fabrication and erection

All fabrication work was carried out by Belconnen Steel Pty Ltd and structural steel shop drawings were prepared by Steeltech Pty Ltd. Erection of the bridge was jointly carried out by JF Hull Holdings Pty Ltd and Universal Cranes Pty Ltd.

Erection of the two tower frames and the nine deck panels (each 11m long) proved fast and was sequenced as follows:

- (1) assemble steel tower frames on-site - lift into position using 90 tonne lattice boom mobile crane on the riverbank.
- (2) north bank - bolt approach span deck panel 1 (nearest the bank) to approach deck panel 2 whilst on the bank.
- (3) lift assembly into position and bolt main span deck panel 3 to assembly. Connect stays.
- (4) repeat steps (2) & (3) for panels 9, 8, 7 on south bank.
- (5) individually lift and connect main span panels 4, 5, 6 (because of crane capacity limitation at maximum reach).
- (6) place precast deck slabs using trolley.

All structural steelwork items are hot dipped galvanised. High strength steel stays were abrasive blast cleaned and coated with three coats of cold cured epoxy-based polyamide resin.

Hale Street pedestrian overpass

JF Hull Holdings Pty Ltd had previously constructed a structural steel pedestrian overpass for the Brisbane City Council at Hale Street, Petrie Terrace. The attractive design, which features a trapezoidal box girder with a clear span of 27m, was prepared by Blain Johnson Pty Ltd for the Brisbane City Council's Works Department, Design Branch. Steel fabrication and erection were undertaken by Belconnen Steel Pty Ltd.



Hale Street bridge is approached on the western side by a footpath which links with a helical ramp of 5m radius (in plan). The ramp facilitates a transition through 270 degrees to an 8.5m long straight ramp of slope 1 in 10. On the eastern side, a dog-legged ramp of span 14.3m provides a transition for pedestrians through 180 degrees. The two bridge spans comprise a 27m main span over Hale Street which is vertically curved and a secondary span of 14m over a parallel service road. The minimum road clearance over



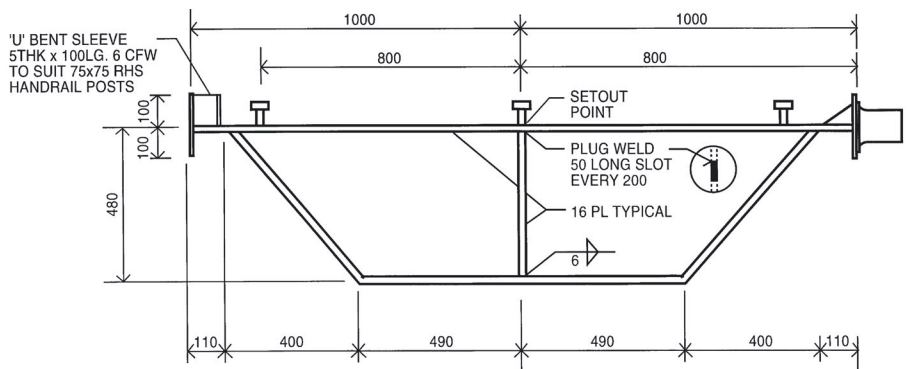
Hale Street is 5.4m and over the service road is 4.4m.

The bridge deck is supported on elastomeric bearings above concrete piers and the deck cross section comprises a 480mm deep trapezoidal box with a top flange width of 2000mm and a bottom flange width of 980mm (see Fig 2). All flange and web plates are 16mm thick. As well as the two inclined web members, an additional 16mm thick vertical web member is located along the section centreline. An insitu concrete deck slab acts compositely with the steel box girder and is connected to the girder top flange by three rows of shear studs. The slab is 125mm thick at the centre and 100mm thick at the edges.

The 1100mm high steel balustrade consists of 75x75x4.0 SHS posts at 3m centres and a 75x75x4.0 SHS hand rail. The bottom rail is a 65x12 Flat whilst the balusters are 20mm dia rods at 140mm centres.

Steelwork is painted internally with ROZP and externally with an epoxy paint system

Figure 2 Typical Section of Bridge Deck



Steel bridges in the Sunshine State- continued

over a 100 micron hot zinc spray. The bridge was erected in three stages with the western approach helical ramp being erected first, followed by the eastern approach dog-legged ramp and service road span, both using a 50 tonne mobile crane. Finally, the curved main span was positioned over Hale Street using two 50 tonne mobile cranes.

Conclusion

Successful construction of two pedestrian bridges - the Caboolture River bridge over water and the Hale Street bridge over road - demonstrates the essential advantages of structural steel in this form of construction. Apart from the skeletal form of steel which provides an aesthetic advantage, steel's faster speed of construction and lighter mass means that it is more easily and economically erected over road and water - all of which bestows an environmental and cost benefit on the project.

Project Participants

Caboolture River Pedestrian/Bikeway Bridge

Client: Caboolture Shire Council
Construction & Erection: JF Hull Holdings Pty Ltd
Universal Cranes Pty Ltd
Consulting Engineer: Benard-Connolly & Partners
Fabrication: Belconnen Steel Pty Ltd

Hale Street Pedestrian Overpass

Client: Brisbane City Council
Design: Blain Johnson Pty Ltd
Fabrication & Erection: Belconnen Steel Pty Ltd

Caboolture River Bikeway Bridge

