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.

Missing

A steel arch bridge spanning the Yarra River appeared overnight much to the surprise of passing motorists. Located adjacent to Melbourne's South Eastern Freeway, St Kevin's College and Scotch College in Toorak, it provides the vital missing link between the main Yarra bicycle and pedestrian trail and the Gardiners Creek path.

The bridge opens up Melbourne for some 250,000 people who can now cycle into the city to work, study or just to enjoy a cappuccino at one of Southgate's cafes. Roads and Ports Minister, Bill Baxter, and Conservation and Environment Minister, Mark Birrell, opened the bridge. Mr Baxter pointed out that the new link would ensure the safety of cyclists who "no longer need to mix with the traffic on Glenferrie Road and other local streets in Richmond and Hawthorn".

As part of a $3.7 million project, the arch bridge incorporated construction of a 740 metre long truss bridge on its approaches. The trusses are suspended from the piers of the existing South Eastern Arterial elevated roadway, with the exception of two spans adjacent to the arch supported on reinforced concrete piers.

Arch Bridge Details

Providing 2.5 metres of footway width, the bridge spans over 70 metres matching the main span of the adjacent road bridge. The steel arch is comprised of two individual ribs and has a rise of around 11.8 metres. All steel being Grade 250.

The ribs consist of 500x20mm top and bottom plates with webs varying in thickness from 12 to 20mm. Rib depth varies along the bridge from 500mm at the centre to 1000mm at each end with top and bottom profiles being on different parabolas. Seven crossbeams connect the ribs laterally with one large crossbeam at each base to anchor the longitudinal ties. At each of these locations there is substantial internal stiffening of the ribs.

The longitudinal ties, which comprise 38mm diameter prestressing bars, are located inside 250x150 RHS (Rolled Hollow Sections) which have a curved profile. Decking comprises precast prestressed concrete slab units spanning between and supported by the RHS ties. Galvanised 16mm diameter, 19 wire strand with swaging sockets at each end hang from the ribs to support the RHS and decking.

Supporting the arch are pot bearings on single column reinforced concrete piers. One of the bearings is fixed laterally and longitudinally and three are free to slide in the longitudinal direction. This arrangement is required to minimise the torsional effects on the slender piers.

Several site constraints initially had the tendering contractors scratching their heads for answers. For example, how to fabricate the parabolic arch ribs with constantly varying depth, and how to erect the bridge on a site which precluded cranes with high voltage power lines on one side and a busy road bridge on the other. Solutions unfolded as the tender winners, Austral Piling Constructions Pty Ltd, proceeded with construction.

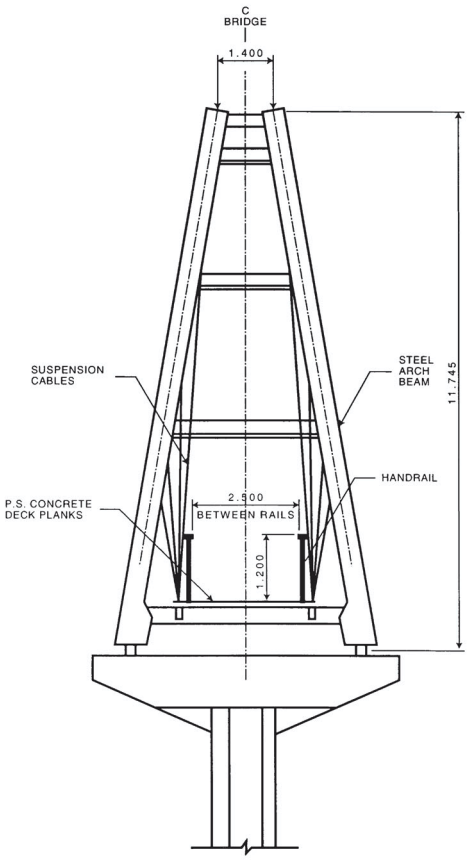
Design aspects

Design was carried out by VicRoads Bridge Design Department and was based on the 1976 NAASRA Highway Bridge Design Specifications. The design live load is 4 kPa. Mal Thomas, VicRoads Bridge Department, said "A number of alternatives were investigated ranging from a steel truss to prestressed concrete, however from a cost and aesthetic advantage a steel arch was proposed and accepted."

Fabrication

Fabrication of the arches, carried out by Associated Iron Industries, Mordialloc, was the subject of intense planning and discussion. Cutting of the complex plates for the ribs at first seemed a huge problem but turned out to be quite elementary.
Bill Mullany, Company Director, said "The task of cutting the complex plates, which would have been too hard and prohibitively expensive until recently, was made easy by

Link



the use of AUTOCAD and Computerised Numeric Control (CNC) cutting equipment. The shop drawings were done using AUTOCAD in conjunction with Melbourne Drafting Services. The electronic files were then downloaded directly into the steel distributor Murray More's CNC equipment, enabling cutting of the plates efficiently and accurately. This resulted in significant time and cost savings by eliminating duplication of work and potential errors in programming. Assembling the plates in the workshop and welding was an easy task."

After fabrication the steelwork was transported to DH Corrosion Control for painting. Painting specifications called for class 2.5 blast clean, 75 microns of inorganic zinc silicate primer followed by 75 microns polyamide cured epoxy tie coat and a top coat of 75 microns of blue catalysed acrylic paint.

Transport and erection

The steel arch was transported in three separate pieces, the trucks being parked on the existing Freeway Bridge above and adjacent to the site. Disruption to traffic caused by the closure of the city bound lane of the freeway was kept to a minimum by conducting the delivery and erection overnight.

Each piece was dual lifted by two 140 tonne mobile cranes and placed on the pier bearings, falsework towers were erected on temporary piled foundations at the splice location. Site welded splices then joined the pieces to complete the arch in the following days. Erection began late on Saturday night and completed six hours later on Sunday morning in time to reopen the freeway for the city bound traffic.

Austral Piling elected this quick erection method after a structural check of the existing bridge proved satisfactory. The relatively low weight of the bridge sections (19,18 and 19 tonnes respectively) was a key factor in enabling this method.

The imposing size and elegant proportions of the steel arch make it an attractive landmark which complements the leafy surroundings. Advances in steelwork fabrication technology and ingenuity in construction enabled its cost effective realisation.

Project Participants:

Owner / Designer:	VicRoads
Fabricator:	Associated Iron Industries
Construction contractor:	Austral Piling Constructions Pty Ltd