



# 135 year old bridge steelwork restored onsite in days

## Wrought iron railway bridge, Wellington NSW

**A heritage-listed railway bridge originally opened in 1881 crossing the Macquarie River in regional NSW has been restored to be even more resilient than it was 133 years ago with deft planning allowing the steelwork to be installed onsite within a tight 16-day window.**

The Wellington Rail Bridge was one of 12 similar bridges designed for then Engineer in Charge of Rail Bridges, **John Whitton** by **Sir John Fowler**, who also co-designed the Firth of Forth Bridge in Scotland and the London Underground.

Decades of dedicated service supporting increasingly heavy traffic took its toll with cracks appearing in many of the cross-members so the bridge needed to be renewed to handle the demands of faster and heavier trains whilst preserving its iconic wrought iron arched trellis canopy.

Transport for New South Wales funded the works as part of the NSW Government's infrastructure improvement program across the NSW country rail network. Works were delivered on behalf of the State Government by contractor John Holland Rail Country Regional Network.

The heritage value of the bridge along with the higher cost it would have imposed to totally replace it led to repair and ongoing maintenance being chosen as the best solution. The main girders have been replaced to reduce maintenance and carry heavier train-loads, but the characteristic latticework remains in place.

About 35 trains cross the rail bridge each week along the Orange to Dubbo line a mix that mainly includes high speed XPT passenger and heavy haul freight trains. The structure had to be strengthened to enable faster speeds of the passenger train up to 50kph and to handle increased axle loads of freight trains.

The restoration works encompassed replacing steel bracing components, support timbers and decking materials. The steel cross-braces and stringers were entirely replaced as have the timber

transoms that carry the rails. Careful planning was essential to assure the bridge as a vital regional link operational as long as possible.

According to MPM Manager at the Country Regional Network division of John Holland Rail **Wally Morris**, who project managed the works, planning took 18 months and there had also been seven weeks of pre-work on the site.

As a consequence, the bridge was out of action for just 16 days to carry out replacement of the steel deck. The project used 4.5m long sections of 310UC97 for new cross girders and 11-metre lengths of 200UC60 for 36 new steel stringers. During the 16-day outage, two crews of 20 people worked around the clock in a coordinated effort.

Mr Morris said steel beams were the only choice given the need to strengthen the bridge and be able to retrofit beams between the existing bottom chords of the wrought iron structure. Heritage considerations dictated no altering of the bridge's visual aesthetics and working around red lead paint typical of the issues that arise when restoring these older wrought iron structures. The lattice, top and bottom chords of the bridge had to gain heritage approval.

As the existing steelwork was coated with red-lead paint, the structure required encapsulation to ensure no paint flakes were discharged into the river below.

"We also had to conduct archival recording and statement of heritage impact for the local council," he said.

Working on the river crossing location required the erection of scaffolding to install the steel. The design took the underslung scaffold loading into account to ensure the existing structure could take the additional imposed loads and wind loads. Facilitating installation within such a tight window required deft planning by the steelwork contractors. All the steelwork had been 3D modelled by EDC Consultants and coordinated in a 3D environment with the engineering team.

“Once agreed and all parties were satisfied with the 3D model provided, with the approval of the fabricator, we processed all the data and supplied it to the steel distributor for processing, NC-DSTV for the hot rolled products and DXF-DSTV for the plate work connections,” said EDC Managing Director, **Chris Velovski**.

“We welcomed the fabricator, Tubular Steel Manufacturing (TSM) providing us the ability to coordinate these design services with the design and construction teams.

“TSM pointed out some concerns in the design that would not physically work and we all worked together to resolve these issues to ensure they were not discovered onsite and potentially cause unnecessary stress.

“Darren from TSM set up a few testing scenarios advising the engineering team that some of the connections needed to be resolved alternatively and by working together along with John Holland, this was resolved and in a very safe and secure manner.”

“EDC and our people went onsite to clarify the measurements supplied on the engineer’s drawings and to get final dimensions prior to 3D Construction Design Modelling,” said TSM Managing Director, **Darren Nicholson**.

“The steelwork had to be delivered at both ends of the bridge in designated areas and there were also areas set for the scrap metal removed from the existing bridge twice weekly,” he said.

“Due to there being so many steel beams which were similar but not identical, we came up with a colour system for the nine bays of the bridge which we then coordinated with transport to site to ensure the right beams were at the right end of the bridge.

“We supplied two crews to do the installation with John Holland rail people all working as one team. We also tested mock ups in our workshop of the beam connections prior to any fabrication to make sure there would not be any problems with the installation on site.

“We had replaced approximately 3500 rivets with structural grade bolts in the cross girder connections during the pre-work which allowed the installation process to be quicker as we only had to remove bolts rather than rivets during the actual installation.”

Pre-processing of steel sections by the steel distributor’s own facility also streamlined supply conducted over a four week period.

“We worked out that the 204 310UC sections required 3264 slotted holes which all had to be programmed individually due to locations of

holes varying on the majority of the beams as well as having each end coped and notched,” said **Mick Elsley** from Southern Steel’s Thornton distribution centre in Newcastle.

“The 200UCs had 916 slotted holes and there were 816 pieces of 200x200x13 angle machined to 200x85x13 which had 8160 slots/holes processed in them, so in total there were about 12,340 slotted holes processed,” he said.

“There was also about 10 tonnes of 6mm to 25mm plate which was cut and drilled on our profiling machines.”

The finished structure was affixed primarily with specially ordered Huck bolts. Galvanizing was chosen as the corrosion protection as the existing structure is over 130 years old and required a tough thick metallic envelope to cover the entire steel surface to provide protection to maximise the design life of the bridge by 100 years.

The Industrial Galvanizers Corrosion Mapping Model has been used to predict coating life, and shows that the galvanizing on the structural beams (coated to at least HDG 600) has an average life of at least 100 years. The use of HDG steel eliminated potential weather delays possible with on-site coating options, and eliminated the need for remedial touch-up after erection. Being prepared off-site, the steel sections were delivered ready to assemble. Completion of \$4.1 million restoration project was announced on 15 July by State Member for Orange, **Andrew Gee MP**.

“This project will also remove long standing speed restrictions in this section of the Orange to Dubbo Line and will improve the reliability of the network while maintaining the original character of the structure for the local community,” Mr Gee said.

#### PROJECT TEAM

**Asset Owner:** Transport NSW

**Steel Specifier:** John Holland

**Engineer:** Aurecon

**ASI Steel Fabricator:** Tubular Steel Manufacturing

**ASI Steel Detailer:** EDC Consultants

**Principal Contractor:** John Holland CRN

**Hot Dip Galvanizer:** Industrial Galvanizers

**ASI Steel Distributor:** Southern Steel Supplies

**ASI Steel Manufacturer:** OneSteel

