Brinnington Railway Bridge, Manchester

For: British Rail Board

AWARD

Structural Engineers:
Regional Civil Engineer,
British Rail
London Midland Region

Steelwork Contractor:
NEI Thompson Limited,
Horseley Bridge

Main Contractor:
Fairclough
Civil Engineering Limited

The bridge provides support for the double track Romiley to Reddish railway line at Brinnington over the new M63/66 Portwood to Denton section of the Manchester Outer Ring Road.

The single clear span provides an economic solution to the problem of providing accommodation for the diverging carriageways of the M63 and M66 motorways together with provision for the future connection of the A6 (M) Stockport North South Bypass.

With the exception of the 138 metre spans of the Britannia Bridge over the Menai Strait, the bridge has the greatest railway span on the London Midland Region.

The main span is a 120 metre warren truss with an overall height of 14.60 metres and width of 11.00 metres; the construction depth of the bridge, from the rail to the soffit level of the chord is 3.30 metres.

The bridge crosses the line of the motorway at an angle of 45 degrees and provides a clear headroom for road traffic of 10 metres. The level of the bridge follows the gradient of the railway line being 1 in 85.7 towards Manchester. The span is subdivided into 10 equal bays each of 12 metres and a short link span of 4 metres at each end completes the rail track deck between the main span and the abutment walls.

Feasibility

At the initial feasibility stage of the scheme the following designs were considered:-

1. A single span steel tied arch 26 metres in height with a welded battle deck floor.
2. A two span prestressed concrete continuous cable stayed bridge with a 25 metre high central mast.
3. A two span continuous steel warren truss 9.2 metres high with a transversely ribbed steel plate floor.

The single span bridge avoided the problems associated with the construction of the very deep cofferdam required for the construction of the central pier especially with regard to the limited construction width available for the pier. The two span schemes would require an additional third sliding in path.

The clear span also provides a construction free area for the future A6 (M) carriageway beneath the centre of the bridge.

Design

The upper and lower chords of the truss together with the end post members are of box form construction with the main diagonal web member being of plate girder form.

The chords have been fabricated with grade 50D plates varying in 5mm increments from 20mm to 45mm thickness at mid span. The gusset plates have been carefully shaped with smooth curves to provide a high fatigue life. The design of the box section is based upon providing a constant overall external depth and a constant internal width thus enabling all web and gusset plate thicknesses to be varied externally according to the stress requirements.

Special quality steel HYZED, grade 25/50D, was specified for the inside gusset plates of the lower chord due to the presence of the cruciform butt weld formed by the internal diaphragm and cross girder connecting plate.

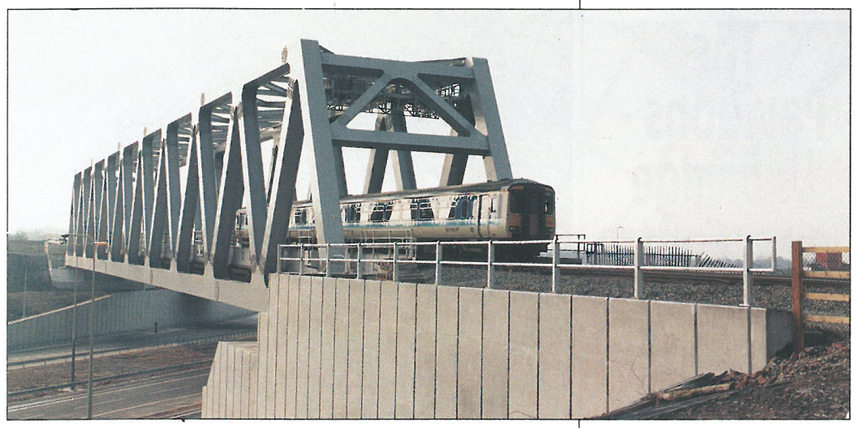
All of the main chord splices together with the gusset plate connections are provided with double cover plates and secured with plated M30 HSFG general grade bolts.

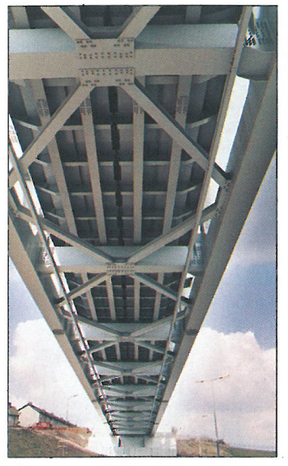
The lower chord is provided with diagonal wind bracing which intersects with the cross girders on the centre line of the bridge. All cross girders are of welded box construction well stiffened internally at the railbearer support positions and provided with single manholes for entry. The cross girders are connected to the main chord members through the end plates and web to main chord gusset plates.

The bridge is fixed at the North West abutment and is provided with an expansion joint at the South East end.

The main truss bearings are of spherical form with low friction liners and are provided with sliding surfaces at the expansion end.

The continuous steel deck which supports ballasted track on hardwood sleepers, is fully protected with a bituminous waterproofing system throughout its entire length and is provided with 3 no. 114mm diameter CHS galvanised steel drainage outlet pipes for each track at the fixed end abutment. Stainless steel grill covers 20mm thick are provided in the floor over the outlet pipes.





Maintenance

The constructional details of the bridge have been carefully designed with a view to preventing the formation of water traps with their associated corrosion problems.

The design provides the necessary working space and means of access for all of the members and bearings which should enable the structure to be inspected and maintained during and possibly beyond its 120 year design life.

The design of the deck, in its component form, will provide a simple unit replacement facility in the event of damage resulting from vehicle derailment. The independent track decks permit access for maintenance and renewal under single line working arrangements.

The protective treatment for the steelwork is the standard B.R.B. system B2, consisting of blast cleaning followed by aluminium metal spray and a four coat chlorinated rubber paint system with the final coat applied on site.

The internal surfaces of the box members were blast cleaned after fabrication and painted with a four coat micaceous iron oxide paint system.

These surface treatments are designed to provide a life of 20 - 25 years between major maintenance re-coating. The internal box surfaces at the main splice positions are also metal sprayed to provide a high quality faying surface.

Costs

The cost of the 1950 tonnes of steelwork including trial erection at Tipton and site assembly plus painting amounted to £4.03m. The total cost of the bridge was £5.82m.

The structure was submitted to the Royal Fine Arts Commission for its consideration in January 1983.

Judges' Comments:

"This is a bold solution to a difficult 45 degree rail over motorway crossing. The well thought out overall design adopts clean lines and has permitted speedy erection. Careful attention to the structural details has resulted in an easily inspected and maintained bridge. An excellent example of a modern major truss girder bridge".