Bridge 6 (Brighton Goods) Reconstruction

Matthew KYNOCH
Senior Project Manager
Mott MacDonald Ltd
Croydon, UK
matthew.kynoch@mottmac.com

Matthew Kynoch, born 1971, received his civil engineering degree from the University of Newcastle upon Tyne. He has 18 years experience in the design and construction of railway bridge projects.

Emily SHORT
Site Agent
BAM Nuttall Ltd
Edenbridge, UK
Emily.short@BAMnuttall.co.uk

Emily Short, born 1980, received her civil engineering degree from the Brighton university. She has 10 years experience in the construction of railway projects.

Summary

The paper describes the civil engineering works needed to replace the bridge structure originally built in 1890 as part of the London, Chatham and Dover Railway providing an interchange at this site between Kent bound services and the many siding lines, depot and locomotive works that used to be present under the bridge.

As part of Network Rail's ongoing structures renewals programme, Bridge 6 (Brighton Goods) on the Victoria to Ramsgate railway line has been upgraded. The existing five span Victorian wrought iron intersection structure, originally built in the late 1890's, was replaced within programmed line closures of the three main Chatham lines out of London Victoria Station with coincident planned line closures of the four railway lines below.

The scheme involved the construction of five individual cast in situ reinforced concrete boxes and associated permanent way alignment design of all seven tracks (three above and four below) to suit the geometry of the new arrangement, which was successfully implemented during planned line blockages of the railway. The base slab for each box is ground bearing with sidewalls cast to fit between the existing piers, the roof cast up to the underside of the existing deck and new parapets cast up and around the sides of the existing girders whilst the existing bridge remained in place.

Particular challenges were the design and construction of five varying high skew reinforced concrete box structures beneath the existing bridge superstructure whilst maintaining operational traffic above and either side of each operational line below; maintaining railway structure gauge clearances to the new structures and the requirements for alterations to the existing track alignments; novel implementation method for the box roof construction; and phasing of the works to suit site constraints and line blockages.

Keywords: Railway bridge; assessment; reconstruction; reinforced concrete; ground improvement;

1. Reconstruction

Bridge 6 is located within a rail locked site immediately south of the River Thames and is sandwiched between the Grade I listed Battersea Power Station and the Battersea Dogs and Cats Home (BD&CH). The existing open grillage deck arrangement is made up of main longitudinal riveted plate girders, cross girders and rail bearers. The main longitudinal girders bear on masonry abutments and piers, with masonry padstones.

The existing bridge piers and abutments remain with the new box structures tied into the piers with additional concrete facing around the ends of the piers, so as to provide the appearance of a new concrete structure. The structural integrity of the existing masonry piers that supported the existing superstructure had to be maintained at all times during the phased construction of each box.

The structural member and reinforcement design was complex due to the varying skew and span arrangement along the length of the 125m long structure. Span 1 has a 70° skew and 6.5m square span whereas Span 5 has a 58° skew and 11m square spans and the remaining boxes between have

https://doi.org/10.2749/222137813806548541

varying skews and spans varied with no two walls being parallel.

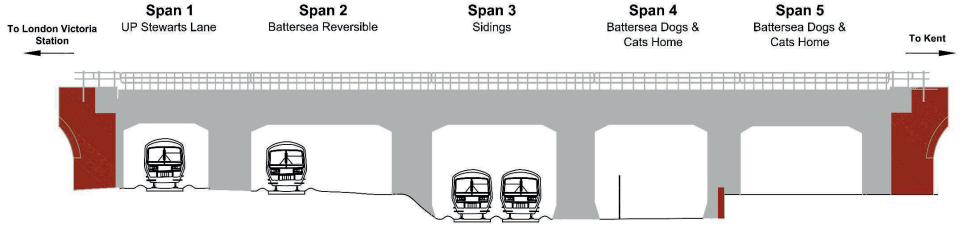

Fig. 1: Proposed Bridge 6 Arrangement

The existing permanent way alignments had to be remodelled in order to provide the necessary structural clearances to the new structure, noting that the new boxes reduced the opening within each span both laterally and vertically. Designed track slues of the all four lower lines were undertaken and a Clear-Route analysis performed to ensure gauging compliance.

The design was developed on the basis of a staged construction sequence working progressively across the site. Given the complexity of the steel reinforcement within the highly skewed base and roof slabs, the decision was taken to work within Span 4 first, as this was being used as a walking route for the BD&CH. Span 4 was constructed outside of railway possessions which enabled the steel fixing team to familiarise themselves with the reinforcement arrangement and in effect was used as a trial for the subsequent boxes.

The sequence of box construction was Span 4, Span 5, Span 3, Span 2 and finally Span 1. Network Rail had pre-booked the rail possessions in advance to coincide with the envisaged construction sequence. The construction period was twelve months with the demolition of the existing structure planned for the Christmas 2011 blockade.

Novel roof construction comprised the erection of temporary support tables where the reinforcement was fixed offline from the final position. Each box comprised three or four tables that were erected and traversed into their final position one at a time, with a 1m separation gap between each table to enable the continuity reinforcement to be fixed between tables.

Due to the emerging changeable ground conditions, based on the presence of peat, varying thicknesses of soft ground, the presence of obstructions determined the need for ground improvement works within these two spans, the solution was to install one hundred and fifty settlement reducing piles in and around the existing track within Spans 1 and 2.

The nine day blockade of the Kent (Chatham) Lines over Christmas 2011, allowed the existing structure to be demolished and the new permanent way to be installed. This work was completed sixty hours earlier than originally planned and the structure was successfully handed back to Network Rail. The remaining civil works were completed shortly after in February 2012.

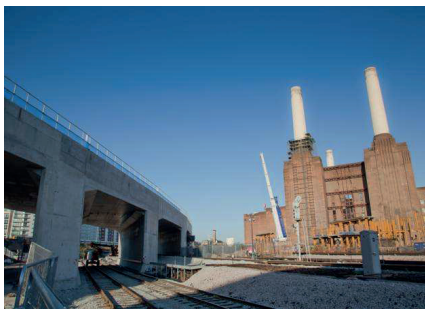

Fig. 2: Completed South Elevation

2. Acknowledgement

The project team won the 2012 British Construction Industry Award (BCIA) for Civil Engineering Project valued between £3M and £50M (The judges' comment "*A great example of a team pulling together to deliver a hugely complicated and challenging project*")

The detailed design of the civil and permanent way works was undertaken by Mott MacDonald Limited in 2010, following which BAM Nuttall Ltd under Network Rail's structures renewals framework were awarded the contract in December 2010 for £7,5 million.