

Reconstruction of Flyover Bridge at Twickenham



WHEN, some seventy years ago, it was decided to construct a single-line flyover bridge to carry the up line from Kingston over the seven tracks west of Twickenham Station on the then London & South Western Railway, it was found necessary to build it on a sharp curve and to use the steepest permissible gradients for its approaches. The three spans were of normal wrought-iron through plate girders, aligned as chords and tangents to the curve and therefore on various skews to the tracks beneath them. Their lengths measured on the square were: north span, 60 ft.; centre span, 52 ft.; and south span 23 ft.; and they were supported by masonry abutments and iron trestle piers sited parallel to the seven tracks.

Recently the renewal of the superstructure was carried out, but the original abutments and piers were retained with modified pre-cast concrete caps fitted to the former and new welded crosshead or capping girders to the latter.

The design of the new superstructure was governed by certain special

factors. Because of the maximum possible gradient of the approaches, the construction depth had to be reduced to a minimum, and this could be done only by providing the shallowest and therefore shortest cross-girders possible. To reduce their length as compared with some of those in the old straight-chord spans, it was decided to use curved main girders to suit the curvature of the track, allowing of cross-girders of uniform length.

It was also decided to prefabricate the new spans so as to secure the most satisfactory conditions for their all-welded construction in a workshop. Actually, this curved design entailed no increase in the total steel required, but the outside girders are stronger than the inside. The new superstructure is believed to be the first all-welded with curved girders conforming to the curvature of the track.

The principal features of the design apart from the curvature are the tension flanges of the new main girders. They are 18 in. wide and have depths varying from $\frac{3}{4}$ in. to $1\frac{1}{2}$ in., and all transverse welding on them, except at the supports, has been

avoided as a precaution against brittle fracture. Moreover, the plates for these bottom flanges were obtained from the rolling mills in single unbroken lengths to avoid joints, although these lengths were up to 62 ft.

The plate girders were fabricated in a jig which had a series of adjustable supports for the web plates enabling the latter to assume their correct curvature; the flanges were curved in a machine before fabrication. The top flanges were in three lengths and, like the web plates, were joined together by welding before being placed in the jig. All bearing plates were bolted to the main girders, and all joints on the underside of the deck were completely sealed by welding as a protection against locomotive exhaust fumes.

The conditions to be considered in the problem of moving the complete spans from the works of Joseph Westwood & Co. Ltd., at Millwall, on the east side of London, where they were fabricated, to Twickenham were that the heaviest one weighed 34 tons and that, because of the

skew ends and curvature, the maximum size of the load was 75 ft. long, 15 ft. wide and 5 ft. 6 in. high. After careful investigation it was found that even so bulky a load could be sent by road, provided that two independently-steered trailers could be used to negotiate sharp corners, and this was successfully accomplished.

The spans were transferred by locomotive crane from Station Road, Twickenham, to railway wagons, and then shunted to a track there they could be unloaded by the crane on to the storage site stallage. Final preparations were there made for erection, including the waterproofing and tiling of the decks and final painting. With the aid of 45-ton locomotive cranes on the tracks below, the old spans were removed and the new ones substituted, with all ancillary works, within the space of a possession of 32 hr.

We are indebted to Mr. M. F. Palmer, of Joseph Westwood & Co. Ltd., and to the Institution of Structural Engineers, for permission to reproduce the accompanying illustration of the bridge.