

River Mardle Viaduct

During the design stages of a diversion of the A38 Trunk Road from Ashburton to Buckfastleigh in Devon, engineers were faced with the problem of bridging three obstructions very close to each other; an access road to the Dart Valley Railway, the River Mardle and an unclassified County road. The A38 was to be rebuilt as a dual two-lane all-purpose trunk road with a design speed of 100kph. Because of local constraints it crossed the area in question at a height of 16m above river level, on a centre line radius of 573 m, a cross-fall on each carriageway of 1 in 14½ and a longitudinal fall of 1 in 72. It was decided that a viaduct had advantages over three separate bridges connected by embankments, not only as a result of a cost comparison between the alternatives but also because of the reduced area of land required and the avoidance of disruption to the construction sequence which would be caused by alternating short lengths of embankment and bridges. The soil survey did not anticipate any foundation problems, so the pier positions were determined solely on the basis of the river and two roads to be crossed. The cost comparison showed that of the possible types of viaduct a composite steel and concrete superstructure was the cheapest; with the span lengths determined by existing obstacles and with complicated geometry the steelwork had to be fabricated rather than based on rolled sections. In addition to the economy of materials, the uncluttered appearance of the twin box arrangement was considered to be of importance as large numbers of people would pass under the bridge on the access road to the scenic Dart Valley Railway. After the design had been completed, the

Interim Report of the Merrison Committee was published and a reappraisal had to be carried out as well as an independent check of the revised calculations. This led to an increase in the weight of steel, but not to any basic change in the original concept. During construction, serious unexpected difficulties were experienced with the foundations which led to extensive additional excavation and foundation works. As the foundation pressure is a function of not only the vertical load but also the friction-induced horizontal force, the comparatively light weight of a steel superstructure proved to be a major advantage in these circumstances which could not have been foreseen when it was originally chosen. The extensive delays caused by the additional works were largely overcome by the speed with which the steelwork was erected, and the use of long prefabricated sections of box girder meant that only limited support was required from the ground. In consequence, the two roads and the river were not obstructed at any time. Now that the River Mardle Viaduct is complete, it is possible to make a realistic assessment of the original decisions concerning the choice of structural medium. Everyone who has been associated with the project has been well pleased with the steel box girder design in spite of the complexities of the Merrison check, and because of the help it afforded in overcoming the foundation problems. For the reasons outlined here, it is felt that steel was the most appropriate material to use for the bridge superstructure.

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Judges Comments

The viaduct is set in an area of natural beauty and the use of steel provides an elegance which lessens the impact of the structure on its environment. The light superstructure is not only economically advantageous but by reducing the vertical and horizontal loads, leads to economy in the foundations which are in a difficult material. The good workmanship enhances the clean lines of the design so that the viaduct which is frequently seen from below presents an attractive appearance from all aspects.

