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Deformation compatibility during erection of steel bridges : case of a 2-span railway truss bridge

Philippe Van Bogaert
Philippe.vanbogaert@ugent.be
Civil Engineering Department/Ghent University
Ghent, Belgium

ABSTRACT

Often insufficient attention is given to the compatibility of the deformations of steel bridges during their assembly on the construction site, especially if continuity, due to bending moments, is to be ensured at the level of intermediate supports. This does require to compensate during assembly the difference in the angular rotations at the location of the support points. The effect is especially noticeable with longer spans or with flexible superstructures. In the case of the construction of a double railway bridge over the Albert Canal (Belgium), the above was an important issue. The bridges are in the shape of a classic Warren truss girder. An unusual process was followed for the assembling on site. In the first phase, the entire lower chord, including the bridge deck, was built and supported in all nodes of the truss. The sloping diagonal bars are connected to this and the upper member of the truss is then mounted on top. In such construction the diagonal bars tend to twist and bending moments are created in the lower truss nodes. Gaps may appear in the upper nodes, due to the unequal displacements of the members to be connected. Calculations must show whether stress-free corrections can be made for the fabrication of the various bars, thus avoiding stresses due to the erection process. This example clearly shows that the compatibility of the components of steel bridges during their assembly must be determined in detail and that efficient measures are needed to compensate for defects.

Keywords: erection of steel bridges, deformation compatibility, steel truss bridge, stress free assembling.

1 INTRODUCTION

The 129 km long Albert canal connects the city of Liège to the port of Antwerp in Belgium, thus allowing to overcome a height difference of 56 m. It is one of the few larger waterways and the bridges crossing it are of the largest spans in this country. The canal was originally built for 2000 T vessels, but gradually accepted larger ships. The expansion of fluvial traffic, especially of containers, has required to enlarge the canal and provide more vertical clearance up to 9.10 m. This will allow 10000 T vessels with 4-stack containers passing in both directions to use the canal. The increase in vertical clearance has required the renewal of 62 bridges. This major project was realized in several steps and is reaching its end point. Most of the bridges are steel tied arches of a similar type, thus achieving a certain degree of recognisability of the canal as described by Dumortier and De Ville de Goyet (2021).

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