The design of the anchoring of the steel double track railway integral bridge in Mechelen contrasting the historical Vierendeel bridges

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Abstract

In extending the existing railway infrastructure from Brussels to Antwerp, a new double track railway infrastructure has been built as a by-pass along the station in the city of Mechelen. In combination with these works, also a road infrastructure, further called the tangent road, was also constructed in which both infrastructures were bundled to the maximum. In crossing a local canal a new railway bridge is designed parallel to historical steel Vierendeel bridges and on top of the new tangent road tunnel going underneath the canal. The paper describes the final design and realization of the new railway bridge contrasting in all its aspects to the Vierendeel bridges with riveted bolt connections. The bridge consists of two lateral main girders having variable rectangular sections and is designed as an integral clamped structure without any bearings. The superstructure is fully welded and the main box girders have a maximum height of 3.65 m near the abutments. The lower flange remains almost horizontal and is slightly twisted about a horizontal axis thus becoming wider near the centre. The upper flange decreases significantly and becomes smaller near mid span where the box girder has a height of 1.65 m. This creates a waving pattern of the structure both in a horizontal plane as in the front view showing an inversed curvature near to the arch springs of the Vierendeel bridges. The concept differs from a more classical integral bridge by the extreme large stiffness of the abutments on top of the tunnel consisting of diaphragm walls. The steel structure is hereby almost perfectly clamped by post tensioning anchors.

Keywords: steel railway bridge, integral bridge, clamping.

1 Introduction

In extending the existing railway infrastructure from Brussels to Antwerp, a new double track railway is foreseen as a by-pass along the railway station in the city of Mechelen. In combination to this project, a new road connection between the southern and northern part of the city as well as a new railway station will be built. In the southern part, this new road is situated in a tunnel under the by-pass railway. In designing the project, the process in obtaining a building permit in the city centre was very difficult dealing with historical and environmental conditions. A lot of attention was given in the architectural integration of structures. In this paper, only a particular situation in the southern part of the project is described. In crossing a local canal a new railway bridge must be designed parallel to historical steel Vierendeel bridges. A new bridge is only acceptable if it could be fully integrated into this historical site as can be seen in Figure 1. This is an air photograph of the existing situation with 3 steel Vierendeel bridges for railway, build in the early 1930's and having a