Design and Construction of an Arch Bridge over Railway Line no. 132 in Poland using BIM Tools

Michal Majka, Patryk Stempin, Dawid Wisniewski
ASECon (Advanced Structural Engineering Consultants), Wroclaw, Poland

Contact: mm@asecon.pl

Abstract
This paper presents the design and construction for the new road-over-rail bridge in Dabrowa, Poland. The bridge is a replacement to the existing structure which significantly deteriorated over the years since the 1960s when it was built. Before the decision was taken to replace the existing bridge, a comprehensive study had been undertaken to investigate the possibilities of refurbishing the existing structure in order to minimise the CO₂ and environmental impact of the project. Ultimately, a decision was made to replace the bridge, driven by the functional constraints related to the very low vertical clearance, which would significantly restrain any future enhancements to the railway line forming a part of the Trans-European Transport Network (TEN-T). The paper discusses non-conventional technical solutions that were applied to the design and construction of the bridge.

Keywords: arch bridge, plate hangers, BIM tools, TEN-T railway network, temp. railway shielding structure.

1 Introduction
The paper discusses the design process as well as construction of the new road-over-rail bridge along the National Road no. 46 in Dabrowa in Poland, crossing over one of the main railway lines in the country. In particular, certain non-conventional technical solutions and aspects of the design adopted to improve the longevity and resilience of the bridge, are presented, including:

- the structural arrangement consisting of stiff steel box girders strengthened with flexible arches and equipped with flat-plate hangers with rigid connections in order to counteract the out-of-plane buckling of the arches;
- the use of weathering steel in locations with difficult access, such as underside of the deck in order to simplify the future maintenance in the vicinity of the railway overhead lines, in the spirit of reducing the life-cycle costs;
- the use of the temporary shielding structure protecting the railway line and infrastructure, in order to minimise the impact of the construction on the railway traffic, to minimise the need for the rail closures and possessions and hence, to reduce the social costs of the project;
- the use of the three-dimensional BIM-based tools in the detailed design and construction to simplify the handling of the complex geometry in design, to simplify the fabrication and to allow for efficient changes in construction.

The bridge crosses over a double-track electrified railway line no. 132 between Bytom and Wroclaw in Poland, in km 111+736 of the line forming a part of the Third Trans-European Corridor within the TEN-T Rail Network. The structure is located on a stretch of the national road network with a high intensity of average daily traffic (ADT)