

Building bridges from thin-walled precast elements

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Abstract

In the construction of Lafnitz Bridge and Lahnbach Bridge thin-walled precast concrete girders with an U-shaped cross-section were used in order to reduce the weight during the construction process. The usage of light-weight girders was advantageous because the girders were erected in the vertical position and rotated into the final horizontal position during the first application of the balanced lowering method. After filling of the girders with in-situ concrete the webs of the bridges were completed. On top of the webs a deck slab was cast using a formwork carriage. While the application of the balanced lowering method permitted a fast construction of the webs, the production of the deck slab with a formwork carriage was a slow process. Therefore a method for the fast production of the deck slab was developed. In this new method precast slab elements, which are stiffened by cross-beams, are placed on top of the webs. This enables a fast construction of post-tensioned concrete bridges with a plate girder cross-section.

Keywords: Post-tensioned bridge, sustainable, thin-walled, precast deck slab element, balanced lowering method, precast girder

1 Using thin-walled bridge girders for the construction of Lafnitz and Lahnbach Bridges

In the years 2019 and 2020 two bridges across the rivers Lafnitz and Lahnbach were built in Austria. In the construction of these bridges the balanced lowering method was applied for the first time. In the balanced lowering the bridge girders are first assembled in a vertical position and then rotated into the final horizontal position. In order to rotate the bridge girders additional structural elements (compression struts) are required. In some topographical situations it will be more efficient to build the bridge girders with this innovative method than with the conventional construction methods like incremental launching or balanced cantilever method [1].

The two bridges are part of the new S7 motorway „Fürstenfelder Schnellstraße“ in the southeast of Austria. The lengths of Lafnitz Bridge and Lahnbach Bridge are 116 and 105 m, respectively. The bridge structure are very similar and each consists of two parallel crossings 14.5 m wide. The cross-section of each crossing was designed as a plate girder with two webs and a construction height of 2.0 m. The areas where the two bridges for the S7 motorway were built are ecologically sensitive and part of the „Natura 2000“ nature reserve. The bridges were needed to cross the rivers and provide options for a passage for deer. A more detailed description of Lahnbach Bridge is contained in [2].

The bridge girders and the compression struts were designed using thin-walled precast elements in order to keep the weight of the elements, which were to be rotated during the lowering process, as low as possible. By minimizing the weight of the