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Comparative Assessment of Bridges designed according to Balanced Lift Method and Balanced Cantilever Method

Georg Gaßner, Kerstin Fuchs, Johann Kollegger

TU Wien, Institute of Structural Engineering, Vienna, Austria

Contact: georg.gassner@tuwien.ac.at

Abstract

In recent years a new bridge construction method has been developed at the Institute of Structural Engineering of TU Wien. The so called Balanced Lift Method can be seen as an alternative to the Balanced Cantilever Method.

To compare these two construction methods, an alternative design using the Balanced Lift Method for the 210 m long San Leonardo Viaduct was prepared. Starting with building the pier and the vertical installation of prefabricated elements for the compression struts and the bridge girder, the construction is ready for the lifting process. A simple way to describe this lifting process is to compare it with opening an umbrella. To create a monolithic structure, all thin wall precast elements are then filled with in-situ concrete. Finally, it can be said that for the evaluated bridge a reduction up to 30 % of the concrete mass would be possible by using the Balanced Lift Method.

Keywords: bridge construction method, precast concrete elements, post-tensioning, Balanced Cantilever Method

1 Introduction

Considering the possibilities of building an arch, there are at least three different construction methods. One is the conventional erection of the arch on a falsework as seen in Figure 1. In situations, where the distance from the ground to the construction is not that high, as it was the case by building the Egg-Graben-Bridge, a falsework is an economical solution for building the arch [2]. Using only post-tensioning tendons for the bridge deck and no mild steel reinforcement, the Egg-Graben-Bridge has a high quality related to the durability without reducing the load capacity. For this design, TU Wien won the fib Award for Outstanding Concrete Structures in 2014.

Another bridge construction method is the cantilever method. The bottom left picture of Figure 1 shows a recently erected bridge, not yet opened for traffic. In 2015 the arch of the Tamina-Bridge in Switzerland was closed. The Tamina-Bridge spans a deep valley and the small river Tamina with a 265 m long arch [3]. For building the arch, stay cables are anchored on a pylon at the abutments for reducing the bending moments in the structure. With this method it is possible to erect the arch without touching the ground of the valley.

The bottom right picture of Figure 1 shows the Lussia footbridge in Italy. This was the first bridge, built by lowering concrete arch halves by Riccardo Morandi. Troyano [7] describes the building process by building the arch halves in a vertical position and then rotating them on a bottom joint. Only a few cables on top of the arch halves are needed for the rotation process.

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