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ScienceDirect

Procedia Engineering 156 (2016) 334 – 339

Procedia Engineering

www.elsevier.com/locate/procedia

9th International Conference „Bridges in Danube Basin 2016“, BDB 2016

Reconstruction of the Oldest Reinforced Concrete Bridge in Slovakia in Krásno nad Kysucou

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Abstract

Road bridge in town Krásno nad Kysucou, spanning the river Bystrica, is considered to be the oldest preserved reinforced concrete bridge in Slovakia and one of the oldest Monier type arch bridges in Central Europe, which are still in use. The bridge was completed in 1892, it survived both World Wars and served until 2014 without any major repair. However, preliminary structural analysis performed in 2012 has shown, that it is not able to safely carry the increased traffic loads according to new European standards.For this reason, and also in order to maintain this technical monument, its reconstruction was undertaken in 2014. Article deals with the description of the original bridge and its historical aspects. It also reports on mechanical properties of the 123-year-old concrete as well as on the final reconstruction of the bridge.

Peer-review under responsibility of the organizing committee of BDB 2016

Keywords: concrete, bridge, monier arch, service life, reconstruction

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Peer-review under responsibility of the organizing committee of BDB 2016
doi:10.1016/j.proeng.2016.08.305

1. Introduction

First patents of concrete structures reinforced by steel wires and rods emerged in 50. and 60. of the 19-th century. The first reinforced concrete bridge was built by Joseph Monier in 1875. Later his patent for construction of reinforced arch bridges was bought by the G. A Wayss company, which then in years 1884-1891 built 320 bridges of this type in Europe [3]. Among the most interesting bridges built by the G.A. Wayss Company in the former Austro-Hungarian monarchy is also the bridge in Krásno nad Kysucou in Slovakia, built in 1892 (Fig. 1). It has survived the World Wars without any damage and served until 2014 [9]. The old age has been indirectly confirmed by the original stone pavement found under asphalt layers during its reconstruction. This unique bridge with a statue of st. John of Nepomuk placed within its railing was in a very good technical condition even after 120 years in service with hundreds of cars passing it every day. However, due to the increased demands for its reliability, in terms of new European standards, and also due to the effort of the city administration to maintain this technical monument, it was decided to refurbish and strengthen its structure as well as its approach roads.

Fig. 1. Bridge in Krásno nad Kysucou, photo taken before reconstruction

2. Description of the original structure

The bridge consists of two reinforced concrete arches supported by stone abutments and stone central pier, which were the part of a previous stone arch bridge. Each arch has a span of 16.8 m and a span to rise ratio of 0.138 m (Fig. 2). The thickness of the primary arch is variable from 400 mm in the springing to 150 mm in the crown of the first arch, and only 130 mm at the crown of the second arch. Above the primary arch, which is reinforced at both surfaces, there is also an unreinforced overfill, which reaches a thickness of up to 600 mm near the springing and gradually diminish towards the crown. This additional layer of plain concrete is situated only between the spandrel walls, not reaching the side edges of the bridge and extends only about to one third of the span from both sides. Rise of the arches is 2.40 m. Free width on the bridge was 6.1 m.

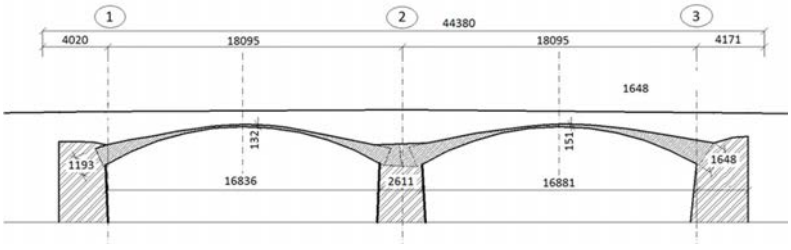

Fig. 2. Real dimensions of the arches including the original additional concrete filled over the vaults near the supports, measurement performed after removal of the arch backfill.