



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

Material properties and carbonation depths measured on seven, more than a 100-years old, concrete bridges in Slovakia

Peter Paulík^{a*}, Michal Bačuvčík^b, Patrik Ševčík^b, Ivan Janotka^b

^a Slovak University of Technology, Faculty of Civil Engineering, Radlinského 11, 81005 Bratislava, Slovakia
^b Building Testing and Research Institute, Studená 3, 82104 Bratislava, Slovakia

Abstract

The oldest Reinforced Concrete Bridge in Slovakia was built in 1892 in Krásno nad Kysucou and it was reconstructed in 2014, after being in service for more than 120 years. There are many other concrete bridges in Slovakia older than 100-years, which are still in daily use. Mostly no drawings nor structural design calculations were preserved from the time of their construction. Also only a very limited information is available about the concrete and reinforcement properties used at the turn of the 19th and 20th century in Slovakia. Thus, any reconstruction of such an old bridge is always based on some preliminary assumption, which are in many cases quite far from reality. The primary aim of our research was to study the material properties of concrete and steel reinforcement used in bridge construction industry 100 years ago in the region of Slovakia. Drilled core samples were taken from various parts of bridge structures for further laboratory analyses. Some selected material properties and carbonation depths measured on 7, more than a 100 years old concrete bridges, are reported in this article.

© 2016 Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

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

Keywords: material properties, concrete, bridges, history

1. Introduction

Research was focused primarily on the category of 100 years old reinforced concrete bridges, which were at the turn of 19th and 20th century only at an early stage of development. No drawings nor information about their structure have been preserved and no relevant standards existed at the time of their construction. Another unknown are the

* Corresponding author. Tel.: +421-903-585663; fax:.
E-mail address: peter.paulik@stuba.sk

material properties of such old concretes and reinforcements as well as the progress of their deterioration. The results of the research project should provide at least some general information about the mechanical properties of concretes and reinforcements used in the construction of a bridges at the very beginning of applications of concrete in bridge construction in Slovakia.

To select representative bridges from this period, we tried to choose those, which are likely to be reconstructed in near future and by this means our research results could be used by the designer in the preliminary stage. Results could also serve for the designers of similar bridges from this construction period as a rough estimate of expected properties. As it turned out, many assumptions made by the designers in Slovakia, when they dealt with the oldest concrete bridges, were quite far from reality.

The following bridge structures, described in various literature [1], [2], [5], [6], were selected for detailed research:

- concrete piers of the old bridge in Bratislava (age of the structure: 125 years)
- reinforced concrete bridge in Krásno nad Kysucou (age of the structure: 122 years)
- reinforced concrete bridge in Hlohovec (age of the structure: 104 years)
- reinforced concrete bridge in Ruzomberok (age of the structure: 102 years)
- bridge truss girder from Hungary, near Slovakia borders (age of the structure: 100 years)
- reinforced concrete bridge in Nižná Myšľa (exact age of the bridge is unknown, but more than 96 years)
- reinforced concrete bridge in Sládkovičovo (exact age of the bridge is unknown, but more than 96 years)

Selected structures are depicted in Figure 1.



Fig. 1: Old concrete bridges selected for the research project (a) Bratislava, (b) Krásno nad Kysucou, (c) Hlohovec, (d) Ružomberok, (e) Nyíregyháza HU, (f) Nižná Myšľa, (g) Sládkovičovo

Even though original drawings have not been preserved, we have found a detailed report about the construction of the piers of the bridge in Bratislava from the year 1891, which was written by the builder Garibaldi Pulszky [8]. In the article, he described the properties of the cements available on the market at that time in the region near Bratislava (former name of the town was Pozsony). In 1889, G. Pulszky tested cements from several different manufacturers and in the article [8] he reports the results of tensile strengths after 1, 7 and 28 days, mass densities and visual appearance of tested cements. According to his report [8], the used Roman cement reached after 7 and 28 days of curing an average tensile strengths of 0.29 MPa and 0.47 MPa. The strongest Portland cement was characterized by an average 28-days tensile strength of 1.48 MPa [8]. Cement samples for the tensile tests, at that time, were made of mortar with cement

Download English Version:

<https://daneshyari.com/en/article/5030166>

Download Persian Version:

<https://daneshyari.com/article/5030166>

[Daneshyari.com](https://daneshyari.com)