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Structural Health Monitoring of Major Danube Bridges in Bratislava

Rudolf Ároch[a]*, Milan Sokol[b], Michal Venglár[b]

[a] *Slovak University of Technology in Bratislava, Faculty of Civil Engineering, Department of Steel and Timber Structures, Radlinskeho 11, SK-810 05 Bratislava, Slovakia*

[b] *Slovak University of Technology in Bratislava, Faculty of Civil Engineering, Department of Structural Mechanics, Radlinskeho 11, SK-810 05 Bratislava, Slovakia*

Abstract

The paper presents some of the intermediate results obtained in the framework of the research program APVV No. 0236-12 granted by the Slovak Research and Development Agency entitled “Bridge Structural Health Monitoring via Repeated Dynamic Tests”.

The paper describes initial structural health monitoring (SHM) tests of the Port Bridge and of the Slovak National Uprising Bridge across the Danube River in Bratislava, Slovakia. The first one is a highway and railway continuous steel truss bridge with 4 spans and a total length of 460.8 meters (largest span 240.8 m). The second one is an asymmetric cable-stayed steel bridge with an orthotropic 2-box beam supported in one plane by cables from an inclined pylon. The total length is 431.8 meters (largest span 303 m). The paper is aimed at different topics: the description of the test setups, the measuring accelerometer polygons synchronized by Wi-Fi connection, synchronization of the video footage with the measurements, etc. Some natural frequencies and mode shapes have been identified from the operational modal analyses.

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Keywords: Structural health monitoring (SHM), truss bridge, cable-stayed bridge, FEM modelling and analysis, operational modal analysis

1. Introduction

Structural health monitoring (SHM) of bridges represents nowadays a topic followed by many researchers, see e.g. [1], [2], [3], [5], [8]. The aim of this paper is to describe some initial structural health monitoring (SHM) experiments of two large bridges across the Danube River in Bratislava, the Port Bridge and the Slovak National

* Corresponding author. Tel.: +421 2 59274 365
E-mail address: rudolf.aroch@stuba.sk

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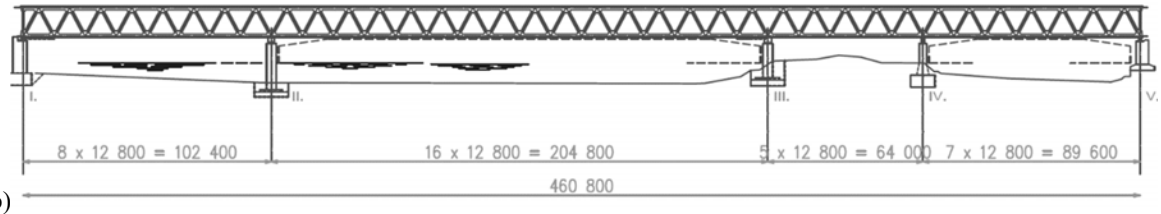
Uprising Bridge. This research has been performed in the framework of the research program APVV No. 0236-12 granted by the Slovak Research and Development Agency entitled “Bridge Structural Health Monitoring via Repeated Dynamic Tests”.

2. The Port Bridge

2.1. Bridge structure

The Port Bridge is located near the Port of Bratislava in the capital city of Slovakia – Bratislava. The road-rail bridge is crossing the river Danube. It has a total length 460.8 m (Fig. 1a) with continuous four spans. The lengths of the spans are: 102.4 m, 204.8 m, 64 m and 89.6 m.

a)



b)

Fig. 1. The Port Bridge (a) side drawing from the south; (b) side view from the north.

The bridge was opened in 1985. Three steel trusses of 11.7 m height with an axial distance of 6.5 m form the bearing structure (Fig. 2). In the lower part a double track railroad and in the upper part a highway is situated. The road part is the component of the Slovak Highway D1. At the lower level of the bridge there are two cantilevered paths designed for pedestrians, cyclists and services. The road deck is a composite steel and concrete structure placed on the tops of the steel trusses in such a way that it does not cooperate in the global longitudinal load-bearing system. The original designed capacity was 50 000 vehicles per day. The amount of passing vehicles is now more than doubled and the Port Bridge is the most used bridge in Slovakia.

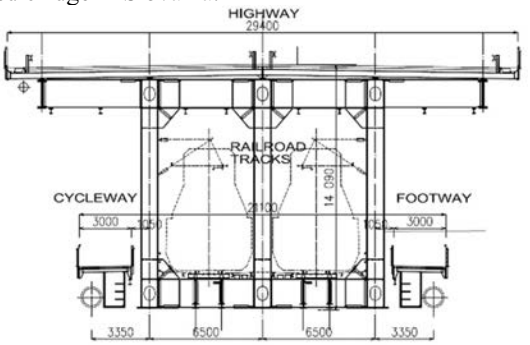


Fig. 2. Cross-section of the Port Bridge.