

Traffic Response Pattern of Cable-Stayed Bridge as a Comparison Tool for SHM

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Abstract

A cable-stayed bridge across the Danube in Bratislava, Slovakia with a 303 m length of the main span was monitored and subsequently the data were used for Structural Health Monitoring (SHM). It was necessary to record the traffic in order to be able to incorporate it into the numerical analyses of the dynamic response of the bridge subjected to a well described dynamic load synchronized with the camera records. For the test's purposes a 28 channel National Instrument system has been used. The vibrations – displacements time series of a few control points on the bottom of the bridge deck have been also acquired using an interferometric radar IBIS-S located below the bridge. A precise FEM model was used to compare the measured values - accelerations and displacements with those from the time history analyses. Response spectra have been compared as well. A specific traffic situation (pattern) was selected from the traffic stream that can be used as a comparison tool for future SHM of the bridge.

Keywords: Structural health monitoring; cable-stayed bridge; NI measurement system; interferometric radar; FEM model; time/history analysis, traffic pattern.

1 Introduction

Structural health monitoring (SHM) of bridges represents nowadays a topic followed by many researchers, see e.g. [1], [2], [3], [4], [5]. The aim of this paper is to describe some initial structural health monitoring (SHM) experiments of a large bridge across the Danube River in Bratislava, Slovakia, the Slovak National 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". Some traffic situations (patterns) were selected from the traffic stream that can be used as a comparison tool for future SHM of the bridge.

2 The Slovak National Uprising Bridge

2.1 Bridge structure

The Slovak National Uprising Bridge is located near the Castle Hill and connects the Old Town with the Petržalka district. It is an asymmetric cable-stayed steel bridge with an orthotropic 2-box beam supported in one plane by cables from an inclined pylon (Figure 1a). The lengths of the spans are: 74.8 m, 303.0 m, and 54 m (total length 431.8 m) (Figure 1c).

The height of the beam is 4.6 m, the width is 21.0 m. On the top deck there is a 2*2 lane road, on the bottom level there are two cantilevered paths for pedestrians and cyclists. Services run