Balance of nature and engineering requirements on existing arch bridges

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Summary

In order to sustain the equilibrium between the nature and requirements on structures based on contemporary standards, research on development of assessment procedures for existing arch bridges exposed to wind load and located in seismic active areas is developing through last few years in Croatia as a part of an extensive project to develop their appropriate maintenance strategy. In this paper an overview of assessment results for Adriatic arch bridges with spans ranging from 200 m to almost 400 m will be presented. More detailed assessment of the Krk Bridge spanning 244 m and exposed to severe wind load will be presented.

Keywords: existing bridges; wind load; linear and nonlinear methods; reliability analysis.

1. Introduction

Numerous existing Croatian arch bridges that have been designed according to former design codes are in daily use and deficiencies and degradation during years of service have additionally reduced their designed reliability levels. In order to sustain the equilibrium between the nature (wind load in some specific locations of Croatian coast, with its turbulent action together with local terrain shape, exceeds the maximum reference wind velocity of 35-40 m /s and almost all parts of Croatia are regions of high seismicity) and requirements on concrete structures based on contemporary standards, research on development of assessment procedures for existing arch bridges exposed to wind load and located in seismic active areas is developing through last few years [1, 2, 3].

Both linear and the nonlinear analysis are used including linear response spectrum analysis and the nonlinear static pushover method for seismic assessment. Results are evaluated within demands defined by current European seismic design codes using the current Croatian seismological chart and Croatian reference wind velocity map developed for Croatian National Application Documents. This procedure is validated by its application to several arch bridges. In this paper an overview of results for Adriatic arch bridges is presented.

Detailed analysis of a certain bridge shows different reliability levels of different elements of arch bridge leading to a priority determination - which parts of a bridge are more critical and need adequate counter measures. This priority determination is a relevant issue to develop appropriate maintenance strategy. In this paper assessment of a Krk II bridge exposed to a severe wind action is presented in more details.

2. Assessment of Adriatic arch bridges

There are six major reinforced concrete arch bridges in Croatia located on the Adriatic coastline, with spans ranging from 200 m to almost 400 m. Four arch bridges, the Šibenik Bridge (246,4 m), the Pag Bridge (193,2 m) and the Krk Bridges (two arches 244 and 390 m) were built during the sixties and the seventies of the 20th century. Two major bridge structures Maslenica (200 m) and Skradin (203 m) Bridges were constructed on Croatian motorways more recently, the first one in

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