Dynamic Assessment of a Curved Cable-Stayed Bridge Based on Multi-Year Monitoring

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Summary

In this paper the experimental and theoretical investigation of a curved cable-stayed bridge is presented as the result of a common research activity carried out between the University IUAV of Venice and the College of Civil Engineering of Tongji University, Shanghai, China. The experimental data were made available by the University IUAV of Venice on the basis of a number of ambient vibration tests carried out by the Politecnico di Milano. In-situ tests include monitoring performed in 2006, prior to opening of the bridge to traffic, and after in July 2010 and April 2011. Recorded data highlighted some differences in bridge response over the years, confirmed by changes in modal frequencies and variations of tension in some stays. Towards the aim of identifying the main causes of these variations, comparative analyses were performed though a tuned finite element model of the bridge, to be used as a base for future long-term monitoring of the investigated structure.

Keywords: curved cable-stayed bridge; dynamic test; modal frequency; cable force; monitoring.

1. Introduction

The considered bridge, located in the Commercial Harbour of Porto Marghera, Venice, Italy, was opened to traffic on January 2007 (Fig. 1). The main two-span cable stayed bridge is characterized by a single inclined prestressed concrete pylon, a curved deck layout and a spatial array of stay cables (Fig. 2) [1][2].

Fig. 1: Photo of Marghera Bridge

Due to the three-dimensional complex layout of the bridge also the structural behaviour appears very complex. This special structure causes significant difficulties in both accurate structural analysis and assessment. Therefore, it has been necessary to carry out investigations and monitoring before and during its service to public. To assess the dynamic behaviour of full-scale bridges, the ambient vibration testing is the main experimental method. Ambient vibration procedures have demonstrated to be especially suitable for flexible systems, such as suspension and

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