MODAL IDENTIFICATION METHODS ON CABLE-STAYED BRIDGES CASE STUDY: RAYITOS DE SOL BRIDGE

Julio León [1*], Carlos Melchor [1]

[1]*Civil Engineering Faculty, National University of Engineering, Lima, Peru*

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ABSTRACT

The accurate estimation of the modal parameters of cable-stayed bridges plays a key role in the safety assessment of these structures under dynamic loads such as traffic, wind, and earthquakes. Furthermore, the difficulty to excite this type of structure makes ambient vibration measurements a meaningful source of information to validate the developed full three-dimensional finite element models used to assess the dynamic response of these types of bridges. In this paper, the Rayitos de Sol cable-stayed bridge was selected as a case study. To evaluate the modal parameters of the bridge, ambient vibration data was gathered from strategic points over the deck. Using the field-recorded data, a series of frequency and time domain system identification methods were carried out and then compared. The collected data was analyzed based on output-only identification methods: peak-picking, frequency domain decomposition, stochastic subspace identification, random decrement, and Ibrahim time domain identification. The purpose of performing different analyses is to examine the efficacy and limits of applicability of these techniques in addressing specific challenges involved in the modal identification of cable-staged bridges. To complement the ambient vibration data analysis, the validated finite element model of the bridge was subjected to artificial ambient excitations to make a comprehensive comparison of the identification methods. In the development of the numerical model, considering the effective stiffness of the concrete reinforced elements as well as modelling the right boundary conditions at the expansion joints were the main factors to achieve a good correlation with the measured modal parameters.

Keywords: Experimental modal analysis, Modal identification Methods, Modal parameters, Cable-Stayed bridge.

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