Remote Monitoring of Bridge Stay Cables

Roman GEIER
Dipl.-Ing. Dr.
Schimetta Consult
Vienna, AUSTRIA
roman.geier@schimetta.co.at

Roman Geier received his civil engineering degree in 1998 and his PhD in 2004 from the Technical University Vienna. Recently he is working as managing director of the Vienna branch office of Schimetta.

Simon HOFFMANN
Dipl..-Ing., PhD candidate
University of BOKU,
Vienna, Austria
simon.hoffmann@boku.ac.at

Simon Hoffman, born 1972, received his civil engineering degree from the Univ. of Aachen, Germany and worked for 5 years as a project manager for Maurer Söhne, Munich.

Johann DISTL
Dipl.-Ing.
Maurer Söhne
Munich, GERMANY
distl@mchn.maurer-soehne.de

Degree in mechanical engineering at the Technical University of Munich in 1991. Working in the R&D Depart. for Structural Protection Systems at Maurer Söhne, Munich.

Summary

Cable forces are highly important parameters for the structural behaviour of cable stayed bridges. In recent years, several new developments were accomplished to receive more exact and reliable data of these parameters. While such tools are becoming common for inspection of cable stayed bridges, long-term or permanent monitoring of cable forces is still limited to research programs or few outstanding bridges. The Austrian research project ISyS aims to improve and implement the systems for cable force measurements in a way, that permanent monitoring will be affordable and easy interpretable. Beside the use of high-tech sensors and hardware, the combination with other systems like semi-active dampers offer a most promising approach to reach that target. Sensors, processing units and power supply are installed to these dampers to reach their optimum efficiency. The combination with force measurements enables to present a complete solution for stay cables.

Keywords: stay cable, ambient vibration, natural frequency, cable force, damping device

1. Introduction

The determination of the acting tensile force in stay cables as well as the assessment of proneness in contrast to vibration excited by wind or traffic is both relevant, if safety of the structure is from major concern. Already in the early 1950s it was tried to evaluate the cable force by the simple approach of sensing the basic mode of vibration by hand. For calculation of the stress the simple coherence function between basic eigenfrequency and tensile force shown in equation (1) was used. The accuracy of course, was not sufficient to fulfil the requirements of civil engineering practice. Thus, the demand for advanced and accurate testing still existed.

Due to improvements in the field of stressing technologies and hydraulic jacks, additional force measurements have not been performed during the construction progress. In addition, later on it is possible to determine the cable force by the same technique. This procedure is known as “lift-off testing”. Although this method is state-of-the-art technology some major disadvantages must be considered. These are for example the difficult application, the risk for the structure and the high costs. The additional load cycle could cause damage to the cable, the anchorage construction or to the global bridge. Hence, lift-off testing was only applied rarely in the civil engineering practice. Another aspect of cable monitoring which must be considered is related to the investigation of prospective vibration problems induced by aerodynamic effects or traffic excitation. For wind-induced vibrations this assessment is usually done by determining damping coefficients. The interaction behaviour between the dynamic response of the observed cable and the global structure is investigated for assessment of traffic-induced vibrations. In order to act against such cable vibration different damping technologies were developed so far. Main target of these installations is to reduce vibration amplitudes of stay cables.

https://doi.org/10.2749/222137807796120300