

MONITORING-BASED RELIABILITY ASSESSMENT OF A STEEL ARCH BRIDGE

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SUMMARY

The paper presents the author's approach to reliability assessment of a structure based on the use of measurement data derived from the structural health monitoring system. The scope of the applied methodology embraces two main parts: the measurement part and the analytical-computational part. The measurement part includes collecting data derived from the monitoring system and creating a database which is the starting point for the next stages. The main area of the work involves probabilistic modeling of the static effects, resulting from the live loads and thermal actions, on the structure, based on the strain measurements. The reliability analyses of the structure conducted for the selected components of the bridge were preceded by defining the limit conditions. The results obtained from the reliability analysis are presented and discussed in the paper.

Keywords: *Structural Health Monitoring, Reliability, Live Loads, Thermal Actions.*

1. INTRODUCTION

Technology development and continuous increase in the number of implementations of structural health monitoring systems in engineering structures in the last decades gives a potential of carrying out comprehensive research in many aspects of life-cycle civil engineering. Hence, not only monitoring techniques, registering devices etc., but also aspects of accurate interpretation and practical, in engineering terms, use of measurement data should be considered of high significance. Long-term continuous electronic measurements provide large amount of detailed information related to structure's condition and performance. Therefore, there are many purposes such systems can serve and it seems essential that the aims of applying monitoring system in each specific case are defined and known before designing and implementing such system, so that it is both reasonable from the economic point of view and practical in terms of the predicted use of acquired data. Once the aims to be achieved based on the measurements are established, it is crucial to apply suitable tools and procedures.

The author's procedure of probabilistic safety assessment of bridge structure components in the operation phase based on the SHM data is described in the article. The key part of the developed procedure refers to probabilistic modelling of traffic loads and effects resulting from thermal actions. Applying the developed algorithms, it was possible to identify the effects induced by considered subdivided loads and actions among all collected values being the structure's static response to the combined operational loads. The results of the following statistical analysis were the input data for reliability analysis of the arch span of Puławy Bridge, Poland.

The methodology, the main assumptions and the details of probabilistic modelling of static effects resulting from traffic loads and thermal actions are described in the article. The results of reliability analysis and the conclusions are presented as well.