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LONG-TERM MOVEMENT BEHAVIOUR OF BRIDGE BEARINGS AND EXPANSION JOINTS FROM SHM DATA

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SUMMARY

Accumulated movements induced by temperature and imposed loads contribute to the wearing down of the sliding materials within bridge bearings and expansion joints, potentially seriously affecting their functioning and performance. Therefore, there is a need for engineers to be able to assess, with some accuracy, the total movements to which these critical components, and their sliding materials in particular, are being subjected (or have been subjected during their service life to date). These movements are difficult to calculate analytically and design codes generally provide very conservative load models which increases the challenge of accurately estimating true movements. Nowadays, structural health monitoring can be used to record these movements with high accuracy, providing data that can support more efficient life-cycle planning of bridge maintenance. This paper illustrates this with reference to the measurement of longitudinal movements on expansion joints and bearings of various bridge structures.

Keywords: *SHM, Bridge bearings, Expansion Joints, Cumulative Movement.*

1. INTRODUCTION

The movements a bridge structure experiences, and in particular the accumulated movements that arise during its entire service life, are a key factor in determining the bridge's life-cycle performance – especially as it relates to the key components (the bearings and expansion joints) that facilitate these movements. These movements are difficult to calculate analytically, with design codes generally providing very conservative load models. And there is still very little documented information about the actual accumulated sliding movements experienced by different bridge types as a function of bridge span/type, geographic location, etc. But structural health monitoring (SHM) systems can answer this need very efficiently in many cases. SHM systems play a valuable role throughout the bridge construction and maintenance industry due to their ability to precisely measure, automatically analyse and immediately make available information of any sort as provided by suitably selected and positioned sensors [1]. Since a bridge's bearings and expansion joints experience the full effects of the structure's movements, traffic and the environment throughout their service life, they can serve as ideal locations to incorporate sensors in order to continuously monitor the components' own performance, and the structure's overall performance, over time. This is particularly true with respect to superstructure movements at such key components' locations, which can cause rapid deterioration of the sliding materials such components typically incorporate in their design. These case studies present estimates of cumulative movements from a number of bridges.

2. SLIDING MATERIALS IN BEARINGS AND JOINTS

Most bearings and expansion joints that facilitate significant bridge movements have sliding interfaces (e.g. as shown in Fig. 1), which provide much of the flexibility required by the main structure's design. These sliding interfaces generally involve the use of non-ferrous materials such as PTFE, which are subjected to friction and abrasion with every movement, and are therefore the component parts that are subjected to the highest

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