

Smart bridge components (expansion joints, bearings and seismic devices) for intelligent infrastructure

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Abstract

Modern automated structural health monitoring (SHM) systems have much to offer the responsible engineers in the construction, inspection, maintenance and renovation of structures in general, and of key structural components such as bridge bearings, expansion joints and seismic protection devices in particular. In the past, monitoring of such components generally involved the use of separate, independent sensors, connected not to the component but to the main structure and provided, to all intents and purposes, as an afterthought to the design and use of the components themselves. Improving technology is changing this, however, with “smart” components now available, with sensors pre-integrated in their design and fabrication before they leave the factory, and data analysis capabilities improving to include automatic identification of component damage based on general testing and teaching of the system.

Keywords: bridge components; SHM; automated monitoring; damage detection; expansion joints; bearings; dampers.

1 Introduction

Recent technological developments in the field of structural health monitoring (SHM), particularly in relation to sensors and data logging, have greatly increased the potential of such technology to play a valuable role in civil and structural engineering – especially as it relates to critical infrastructure such as road and railway bridges. Continually progressing research work, and the innovations of suppliers, have resulted in the development of systems and solutions which can greatly increase the effectiveness and efficiency of bridge construction, inspection, maintenance and renovation work [1].

One such area of innovation relates to the key components which, if present, are generally critically important to a bridge's efficient design and proper functioning: its bearings, expansion joints and seismic protection devices such as

dampers. This has led to the development of “smart” components, which feature pre-integrated SHM sensors already when fabricated, enabling bridge engineers to optimise the efficiency of their work as it relates to their structures' key components (Figure 1).

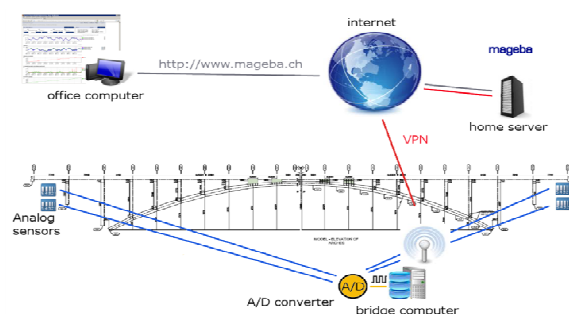


Figure 1. An SHM system with sensors integrated in key structural components can optimise inspection and maintenance activities