

## Recent advancements in the monitoring of bridges using “smart” components

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## 1 Abstract

Making the transition to ultra-long bridge design life requires a paradigm shift in the way bridge maintenance is considered. In order to achieve a very long service life, the maintenance program must be carefully planned and strictly executed throughout the structure's life. A bridge's bearings and expansion joints experience the full effects of traffic and the environment throughout that service life, and can act as ideal “smart” components – incorporating integrated sensors in order to continuously monitor the components' own performance, and the structure's overall performance, over time. Installation and testing of such sensors in factory conditions allows very high quality control, which cannot easily be matched on site. So-called “wear elements”, such as the sliding surface materials in bearings and expansion joints, will need to be replaced a number of times during a long service life, even when using the highest-quality materials available. Recognizing this fact, and incorporating monitoring systems that can track the deterioration of such elements and provide advance warnings for the owner, can result in efficient life-cycle planning of bridge maintenance, vital for major transport infrastructure. Recent developments and added value of such “smart” technologies are discussed.

**Keywords:** Automated monitoring; SHM; bridge; smart components; bearings; expansion joints; dampers.

## 2 Introduction

The idea of applying structural health monitoring (SHM) technology to key bridge components such as bearings and expansion joints to make them “smart” is not new, but the potential benefits of doing so continues to increase for various reasons and can add significant value to projects [1] – including, for example, SHM technology advancements, much improved data transmission possibilities, and the continually expanding experience of suppliers. This shall be discussed below from the perspective of the manufacturer of such key bridge components, who – if also experienced in the development and application of SHM technology – is uniquely well positioned to

develop and manufacture “smart” bridge components such as bearings, expansion joints, dampers and shock transmission units (STUs).

## 3 Background to development of “smart” bridge components

Initially, sensors were simply connected to fully fabricated and installed bridge components, or to the structural elements to which they are connected, primarily to measure movements (e.g. those of expansion joints and sliding bearings).

In the case of bridge bearings, however, the technology had already been developed by leading bearing suppliers to equip bearings of the pot type,