



Improved safety verification of existing bridges using monitored data

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Abstract

Conventional safety verification of existing bridges generally incorporates a combination of visual inspections and structural analysis based on a specified traffic load model, which can be significantly different to the local site traffic. In addition, assumptions regarding the mechanical properties of the various construction materials are generally obtained from codes or test data, which are also subject to much uncertainty. Monitoring of the structural behaviour of bridge elements now offers a viable complement or even alternative to analytical calculations. This paper presents real case study bridges, where data from monitoring has been explicitly used to better understand the action effect behaviour and to verify the structural safety. A number of novel data treatment techniques are introduced for evaluation of extreme and fatigue damaging effects.

Keywords: Structural Health Monitoring, Bridge Safety, Extreme Values, Fatigue Examination

1 Introduction

1.1 Context and motivation

Monitoring of civil infrastructure is not a recent concept. Civil engineers have been recording measurements since earliest records. Early monitoring examples include the Egyptian Nilometer's for measuring flood levels which date as far back as AD 861, whilst records of the height of floodwaters in Rome is available since the 1300's [1].

In the field of bridge engineering, measurements were generally limited to intermittent monitoring regimes until recent years. For studies on creep or thermal effects individual readings per hour, day or week or even year can be sufficient. Technological developments in the past few decades, particularly in relation to data storage, make it now possible to carry out continuous measurement of structures at high frequency.

This work incorporates the study of traffic action effects, which require high-frequency measurement in order to adequately capture individual vehicle events. Additionally, continuous measurement ensures that the daily and seasonal