# Identifying the Frequencies of a Twin Steel Box Girder Viaduct By GPS Monitoring

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## INTRODUCTION

The need to monitor bridge performance has been brought to mind with the recent bridge collapse in the United States in August 2007. With aging infrastructure and many bridges carrying loads that are far greater than predicted during their design, this has increased the need to monitor the performance of bridges. The knowledge of the resonant frequencies of a bridge is very important to bridge/civil engineers. These values are usually computed at the design stage using Finite Element Analysis (FEA). Changes in these frequencies over the lifespan of the bridge may indicate defects in the bridge structure.

The following paper outlines a field test carried out recently on a motorway viaduct in the UK, with a main river span length of 173.7m. Previous research has shown that GPS is a viable tool for monitoring the deformations and deflections of large suspended bridges however tests on a steel box girder bridge of this type has been limited. The following paper details initial trials carried out by researchers at the IESSG and Brunel, investigating the use of GPS to measure the long term deformations and short term deflections of a viaduct carrying six lanes of motorway. The paper outlines the configuration of a number of receivers placed on the structure, as well as provisional results, showing the feasibility of GPS for such monitoring. The tests included the use of two reference GPS receivers located some 2.4 km away from the structure, and a further 5 GPS receivers located at key locations on the viaduct. Leica SR530 and 1200 dual frequency code and carrier phase GPS receivers were used. GPS data was collected at 10 and 20 Hz and post processed using Leica Geo Office. Filtering and spectral analysis was then performed on the data. Three main frequencies were clearly detected by the GPS in the vertical component. The previously known frequency of 0.5 Hz was identified as well as two other frequencies. The report also shows that the peak deflections in the vertical can lie anywhere in the range of ±50mm. Lateral and longitudinal deflections were also analysed. This paper describes the field procedure, data processing and some of the movement and frequency results obtained.

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