

Early Evaluation of Long-Span Suspension Bridges Using Smartphone Accelerometers

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Abstract : Structural deterioration of bridge systems possesses an ongoing threat to the transportation networks. Besides, landmark bridges' integrity and safety are more than sole functionality, since they provide a strong presence for the society and nations. Therefore, an innovative and sustainable method to inspect landmark bridges is essential to ensure their resiliency in the long run. In this paper, a recently introduced concept, smartphone-based modal frequency estimation is addressed, and this paper targets to authenticate the fidelity of smartphone-based vibration measurements gathered from three landmark suspension bridges. Firstly, smartphones located at the bridge mid-span are adopted as portable and standalone vibration measurement devices. Then, their embedded accelerometers are utilized to gather vibration response under operational loads, and eventually frequency domain characteristics are deduced. The preliminary analysis results are compared with the reference publications and high-quality monitoring data to validate the usability of smartphones on long-span landmark suspension bridges. If the technical challenges such as high period of vibration, low amplitude excitation, embedded smartphone sensor features, sampling, and citizen engagement are tackled, smartphones can provide a novel and cost-free crowdsourcing tool for maintenance of these landmark structures. This study presents the early phase findings from three signature structures located in the United States.

Keywords : smart and mobile sensing, structural health monitoring, suspension bridges, vibration analysis

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