6th International Conference on Advances in Experimental Structural Engineering
11th International Workshop on Advanced Smart Materials and Smart Structures Technology
August 1-2, 2015, University of Illinois, Urbana-Champaign, United States

Monitoring and Control of Moving Truck Loads to Mitigate Vehicle-induced Bridge Responses using Mobile Truck-based Wireless Sensors

Rui Hou*, Yilan Zhang, Sean O'Connor, Jerome P. Lynch

** Presenting Author*

Corresponding Author: ***Jerome P. Lynch***
Contact Email: ***jerlynch@umich.edu***

ABSTRACT
Vehicle-induced vibration is one of the primary factors that accelerate bridge aging and deterioration. Reducing the dynamic response of bridges to moving truck loads can be an effective way of reducing long-term deterioration and extending bridge service lives. Currently, the dynamic load imposed by heavy trucks on bridges is not well understood due to the lack of experimental data associated with vehicle-bridge coupled dynamics. This study introduces a wireless monitoring system architecture that autonomously integrates a mobile wireless sensor network installed in a heavy truck to measure truck location and vibrations with a stationary wireless sensor network installed on a bridge. Time-synchronized truck-bridge response data collected can be used as the basis for modeling vehicle-bridge interaction (VBI). The coupling of truck-based sensors and bridge monitoring systems can be extended to potentially control the dynamics of trucks with the aim of minimizing dynamic bridge responses. The proposed wireless VBI monitoring and control system is experimentally validated on the Telegraph Road Bridge (TRB) using a calibrated tractor-trailer truck instrumented with a wireless sensor network.

KEYWORDS: *Sensor Technology, Vehicle-Bridge Interaction, Data Processing, System Identification, Optimal Control*