Project Information Form

Project Title	Next-Generation Wireless Bridge Weigh-in-Motion (WIM) System Integrated with Nondestructive Evaluation (NDE) Capability for Transportation Infrastructure Safety
University	Georgia Institute of Technology, University of Alabama at Birmingham
Principal Investigator	Yang Wang, Nasim Uddin, Laurence J. Jacobs, Jin-Yeon Kim
PI Contact Information	Dr. Yang Wang School of Civil and Environmental Engineering Georgia Institute of Technology 790 Atlantic Drive Atlanta, GA 30332-0355 Phone: (404) 894-1851, FAX: (404) 894-2278 Email: yang.wang@ce.gatech.edu
Funding Source(s) and Amounts Provided (by each agency or organization)	$177,949 (GDOT) + $135,487 (UTC)
Total Project Cost	$313,436
Agency ID or Contract Number	
Start and End Dates	05/01/12 ~ 01/31/14
Brief Description of Research Project	This proposal seeks to develop a wireless WIM+NDE system as a solution to the premature transportation infrastructure safety problem, for the first time ever, in a two-fold approach: control of overloaded trucks and safety assessment/monitoring of transportation infrastructure. The system contains individual wireless sensing nodes that integrate state-of-the-art shear strain sensors suitable for concrete bridge components, and ultrasonic nondestructive evaluation (NDE) devices suitable for steel components.
Describe Implementation of Research Outcomes (or why not implemented) (Attach Any Photos)	Task 1 - Development of a wireless sensing node supporting both WIM and NDE • Off-the-shelf component selection for wireless device has been completed. Components have been selected for microcontroller, wireless radio, memory, digital-to-analog converter, etc. • After circuit testing on breadboard, final schematics design and printed circuit board layout for the device are under way.

	Task 2 - Analytical development for WIM • Using LS-DYNA, the geometry of the FE simulation of the vehicle-bridge interaction was finished and each axle weight was applied properly. • A simple and efficient axle detection filter was developed based on digital filter design. Task 3 - Development and implementation of the stand-alone ultrasonic NDE technique • Initial design for ultrasonic signal conditioning circuits has been conducted. • Using an Instron 100-kip fatigue-rated machine, fatigue crack testing has been accomplished with ultrasonic measurements simultaneously taken during the testing. • Off-line diffuse ultrasonic crack detection testing on three concrete blocks with different simulated crack depths has been performed. The measured depths are compared with those from a numerical ultrasonic diffuse wave propagation model.
Impacts/Benefits of Implementation (actual, not anticipated)	Task 1 - Development of a wireless sensing node supporting both WIM and NDE • It is confirmed that data acquisition requirements for WIM application can be satisfied by selected electronic components. • In terms of sensing resolution, the team also identified a strain transducer that is rated to provide required noise level of below 2 microstrains. Task 2 - Analytical development for WIM • In the FE simulation, the deflection of the bridge was in the same magnitude and the vibration of the bridge was observed to be larger than it is supposed to be, and the precision would be improved. • A simple and efficient axle detection filter was developed using matched filter based on digital filter design technique. Task 3 - Development and implementation of the stand-alone ultrasonic NDE technique • It is verified that data acquisition requirements for ultrasonic application can be satisfied by selected electronic components. • It is confirmed that the crack depths measured by the diffuse ultrasonic technique are coincident with those predicted by the numerical model.
Web Links • Reports	N/A

• Project website	