WIRELESS MONITORING PROMISES SAFER RAILROAD BRIDGES

Sep 05, 2013

CN freight cars cross the wirelessly instrumented 300-foot main truss of the CN railroad bridge by Chicago.

By Leslie Sweet Myrick

As interest gains in implementing high-speed rail in North America, CEE researchers are developing innovative ways to monitor existing railroad infrastructure to ensure safety for this new traffic.

In a new project for the Federal Railroad Administration led by Professor Bill Spencer, two CEE research centers, the Smart Structures Technology Laboratory (SSTL) and the Rail Transportation and Engineering Center (RailTEC) are working together to develop a portable, cost-effective and practical wireless structural health monitoring system for railroad bridges in North America. Currently, the monitoring options for freight tracks are wire-based, expensive and difficult to deploy.

“The new system is intended for periodic deployment rather than as a permanent installation, so it can be moved from bridge to bridge to maximize its usefulness,” Spencer said. “The wireless smart sensors will provide railroads with up-to-date information about the in-service performance of their bridges. For example, excessive motion of the bridge deck can show a decrease of bridge performance, increasing passenger discomfort and, if ignored, potential car derailment. The goal of the monitoring is to enable

early detection so that corrective action can be taken. As a result, railroads can increase reliability, reduce maintenance costs and better prioritize repairs."

The monitoring project is in conjunction with CN railroad, which has identified a bridge in south Chicago for instrumentation and testing. After developing an analytical model for this specific bridge, the team plans to install at least 10 wireless nodes on the actual bridge to measure train loads, train speeds and bridge response. The field monitoring will then be compared to the analytical models. Over time, the analytical models will be verified and calibrated so that they can become predictive tools for the railroad.

"As a result of this new monitoring system, the bridges will be safer for all rail traffic and easier to maintain," Spencer said.

Spencer and his team from the SSTL have extensive experience working with wireless sensors in Illinois and as far away as Korea. His team accomplished the largest-ever deployment of a wireless smart monitoring system on the Jindo Bridge in South Korea in 2009. This latest project is being conducted in close cooperation with the railroad industry, the Federal Railroad Administration and CEE's own RailTEC. The wireless sensor system should be ready by 2014.

In a related project, Spencer is developing a monitoring system for railroad bridge impacts by under-crossing large trucks and barges.

"The ultimate goal of this research is to produce a sensing strategy that can inform railroads about an impact event in real-time, enhancing the safety of railroad operations," Spencer said. "Although such impacts can inflict immediate damage, if they go unnoticed by the railroad and are not reported by 'hit-and-run' offenders, they can also cause hidden damage that leads to gradual degradation of the structure."

No such system has previously been designed for railroad bridges. The new monitoring system will sense and immediately report the impact, thus promoting prompt inspection of the bridge structure and addressing of potential dangers. The final deliverable set for late 2014 will include a user-friendly interface to help railroad staff interpret the reports.

"We plan to explore the possibility of incorporating a camera which is woken up whenever an impact is sensed to capture images of the offending vehicle," Spencer said.