MOUNTAIN-PLAINS CONSORTIUM

PROJECT BRIEF | MPC 16-306 | January 2016

A Sensor Fusion Approach to Assess Pavement Condition and Maintenance Effectiveness

the ISSUE

This research developed an approach to enable smart pavements. The embedded sensors report parameters to determine traffic-loading characteristics, structural health, and the ride quality pavements provide to the traveling public. This technology will enable agencies to remotely monitor pavement assets comprehensively, without regularly deploying expensive field equipment and personnel.

the RESEARCH

In addition to making the sensors more rugged so that they would last throughout the asset lifecycle, this research developed a new method that extended the capability of the sensors beyond an ability to measure just pavement loading and condition parameters. Specifically, the research linked the sensor output to common roughness indices. To maintain a high accuracy of measuring numerous pavement loading and condition parameters throughout the life cycle of the pavement asset, an external method of roughness measurement provided continuous calibration for the sensors. The connected vehicle method is a novel technique that utilizes regular vehicles with wireless connectivity to measure localized roughness.

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North Dakota State University
South Dakota State University
University of Colorado Denver
University of Denver
University of Utah
Utah State University
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Project Title

A Sensor Fusion Approach to Assess Pavement Condition and Maintenance Effectiveness

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the FINDINGS

Field experiments validated the theory of using connected vehicles to measure pavement roughness, and in turn the ability to use those results as a means of calibrating the embedded sensors so that they will maintain long-term accuracy of measuring and reporting a variety of parameters. Through continuous calibration, the embedded sensors will measure and report parameters that allow agencies to characterize traffic conditions and to assess many aspects of pavement structural health. Numerical simulations further revealed that a sensor placement interval of approximately one meter will provide agencies with roughness measurement levels that are most significant in making maintenance decisions. Therefore, agencies can monitor roughness even when connected vehicles are not providing similar information.

the IMPACT

Embedded sensors that remain operational throughout the lifecycle of pavement assets will provide agencies with a remote means of monitoring the usage characteristics, health conditions, and service level of pavements, without deploying expensive instrumented vehicles that can potentially disrupt traffic. When smart cities design and construct new pavements with the sensors already embedded in the materials, those pavements will save agencies tens of billions of dollars by eliminating the need to regularly deploy expensive probing equipment and personnel.

For more information on this project, download the entire report at http://www.ugpti.org/resources/reports/details.php?id=843

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7938 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.

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