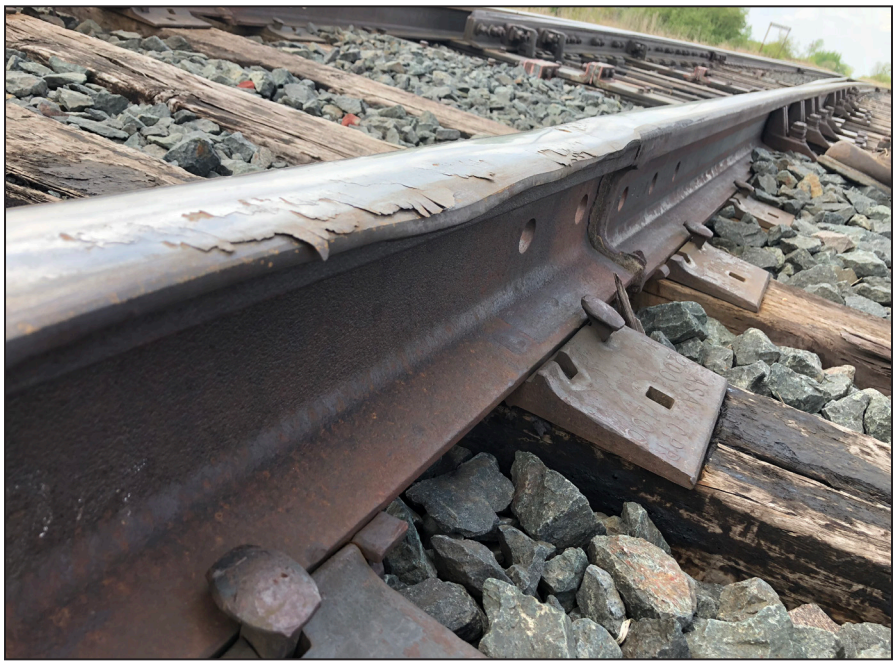
MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 19-384 (project 505) | July 2019

Intelligent Transportation Systems Approach to Railroad Infrastructure Performance Evaluation: Track Surface Abnormality Identification with Smartphone-Based App



the ISSUE

Federal track safety regulations require railroads to inspect all tracks in operation as often as twice weekly. Railroad companies deploy expensive and relatively slow methods using human inspectors and expensive automated inspection vehicles to inspect and monitor their rail tracks. The current practices are not only expensive and decrease rail productivity by taking away track time to perform inspection, but also increase the safety risk for railway inspection workers.

the RESEARCH

Researchers developed and evaluated an automated symptom screening system for railroad tracks and equipment. The system located and characterized possible track surface abnormality by analyzing the inertial dynamics of hi-rail vehicle or in-service rail vehicles using a smartphone data logging application. The research relied on signal processing, data processing, modeling, and signal classification techniques. The method developed in this research will not rely on adapting sensor configurations, and will require only a data upload capability. The new smart-phone based sensors will compress and upload their geo-tagged inertial data periodically to a centralized processor. Remote algorithms will combine and process the data from multiple train traversals to identify abnormal symptoms and localize their position. Track surface abnormality or unevenness classification will enable asset managers to allocate the appropriate specialists to scrutinize the uneven surface location.

MOUNTAIN-PLAINS CONSORTIUM REGION 8

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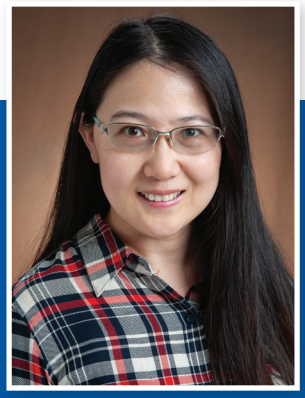

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Project Title

An Intelligent Transportation Systems Approach to Railroad Infrastructure Performance Evaluation

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the **FINDINGS**

The proposed signal-processing algorithms can identify the locations of possible rail surface irregularities. Smart phone sensor data from each traversal provides reasonable location estimation. In the test data, the errors are within 15 meters. This finding is critical because it means that each traversal narrows down the location of a potential surface anomaly to within sight distance. Such a solution would free

A three-smartphone-based data collection system will significantly improve the location estimation to within 5 meters with a single traversal. With two traversals, the estimation can be improved to within 3 meters.

the **IMPACT**

The approach would free up track time and capacity previously reserved for manual inspections as well as improve safety for railroad workers.

For more information on this project, download the entire report at http://www.ugpti.org/resources/reports/details.php?id=954

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7767 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.