UTC Project Information	
Project Title	MPC-551 – Automated Track Geometry Monitoring System
University	North Dakota State University
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Total Project Cost	$198,302
Agency ID or Contract Number	69A3551747108
Start and End Dates	December 4, 2017 to July 31, 2022
Brief Description of Research Project	This study will develop, implement, and evaluate an autonomous track geometry monitoring system to screen the network for faults during normal train operations. The technology performance will depend on the specific implementation and deployment options selected. Therefore, automatic data collection and recording devices will be necessary to gather motion, location, and speed data to evaluate the performance of various system implementation options. Initial data collection will begin with a smartphone that has all of the required sensors. The PIs will develop a smartphone application that will be capable of autonomously collecting and uploading data from hi-rail vehicles where power is available. The technology transfer

	phase will inform commercialization partners about the best approaches to develop a lower-cost and self-sufficient version of the sensor system deployed during the research. This research project will focus on developing the signal processing and machine learning algorithms and models that will transform the on-board sensor data into track geometry equivalents. The research team will also develop a reporting and mapping system to provide decision-makers with a data visualization tool.
Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	The research team deployed three smartphone on a Hi-Rail vehicle which is operated on a local rail line. The research team also developed a data collection app, RIVET which currently serves only as a data collection device and available freely to public at any app store. The proposed method is still at research stage and is not deployed at any agency yet because the proposed method is able to detect and locate surface abnormality location accurately however its projection accuracy is relatively still low with too many false positive rate.
Impacts/Benefits of Implementation (actual, not anticipated)	The research work enhanced the knowledge on how to improve detection and localization accuracy through ensembled data which dramatically reduced the needs for more expensive high-resolution sensors. The enhanced detection accuracy will likely promote users' confidence to adopt the application in the future.
Web Links • Reports • Project Website	• MPC Research Report • Conference Paper – Architecture for an Intelligent Low-Cost Rail Track Condition Evaluation System • Journal Article – Enhancement of Signals from Connected Vehicles to Detect Roadway and Railway Anomalies • Journal Article – Railroad Track Condition Monitoring Using Inertial Sensors and Digital Signal Processing: A Review • Journal Article – Signal Feature Extraction and Combination to Enhance the Detection and Localization of Railroad Track Irregularities • Journal Article – Signal Filter Cut-Off Frequency Determination to Enhance the Accuracy of Rail Track Irregularity Detection and Localization • Conference Paper – Train Speed Estimation Using Low-Cost GPS Receivers