

UTC Project Information	
Project Title	MPC-549 – Benefit Cost Analysis of Railroad Track Monitoring Using Sensors On-Board Revenue Service Trains
University	North Dakota State University
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Funding Source(s) and Amounts Provided (by each agency or organization)	<p>USDOT, Research and Innovative Technology Administration \$64,511</p> <p>North Dakota State University \$65,511</p>
Total Project Cost	\$129,022
Agency ID or Contract Number	69A3551747108
Start and End Dates	December 1, 2017 to July 31, 2022
Brief Description of Research Project	<p>This study will develop, implement, and evaluate a benefit cost analysis (BCA) method to assess the benefits and costs of implementing an autonomous track geometry monitoring system to screen the network for faults during normal train operations. The BCA will quantify and monetize all potential costs and benefits of the technology deployment. Cost estimates will include research to obtain volume dependent pricing for equipment from key manufacturers of all the required system components. A complete autonomous track geometry monitoring system will include wireless sensors, energy harvesting devices, wireless access points, cloud computing resources, and maintenance. Costs such as a first installation may be one-time and other costs such as wide-area network communications and a cloud-service subscription may be recurring. Hence, some of the cost changes may be non-linear over time because of technology commoditization and the dynamic costs for cloud computing services. Quantifying the benefits will involve research and analysis to estimate time and monetary savings for track inspections and the reduction of track closures. Other potential</p>

	<p>benefits are from derailment risk reduction due to more regular inspections. The study will also describe any benefits that are not quantifiable in monetary terms, such as the use of standard web interface tools, the convenience of data visualization, and the modernization of asset management systems that incorporate the technology. In addition, this study will conduct an uncertainty and sensitivity analysis of the BCA under various scenarios proposed by Federal Railroad Administration (FRA) stakeholders.</p>
<p>Describe Implementation of Research Outcomes (or why not implemented)</p> <p>Place Any Photos Here</p>	<p>The publications resulting from this research provided a broad understanding about potential impacts of enhancing railroad technology, enabling trains as part of the Internet-of-things (IOT) with relevance to connected vehicle technology and big data. Progress on emerging papers has increased the body of knowledge and understanding of the potential benefits, limitations, and costs of utilizing low-cost sensors on-board regular service trains to monitor rail track surface conditions. The project has prepared future transportation professionals to develop and apply risk analysis, data mining, and machine learning methods to improve the utility of benefit-cost analysis.</p>
<p>Impacts/Benefits of Implementation (actual, not anticipated)</p>	<p>Adding onboard condition monitoring sensors that can use the PTC network for real-time communications can help railroads avoid billions of dollars in both derailments and human-caused accidents. Railroads can use the BCA models developed in this research to help assess tradeoffs between affordability, performance, and payback period.</p>
<p>Web Links</p> <ul style="list-style-type: none"> • Reports • Project Website 	<ul style="list-style-type: none"> • MPC Research Report