

UTC Project Information	
Project Title	MPC-612 – Studying the Use of Low-Cost Sensing Devices to Report Roadway Pavement Conditions
University	University of Colorado Denver
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Funding Source(s) and Amounts Provided (by each agency or organization)	<p>USDOT, Office of the Assistant Secretary for Research and Technology \$39,999.99</p> <p>University of Colorado Denver \$43,448.39</p>
Total Project Cost	\$83,448.38
Agency ID or Contract Number	69A3551747108
Start and End Dates	February 18, 2020 to July 31, 2024
Brief Description of Research Project	<p>Road networks require regular inspection and repair to maintain their performance and function. Several techniques are currently in practice for inspecting roadway performance for presence of cracks, potholes, and other distress such as: inspectors that visually judge the road conditions, specialized vehicles that measure distress with laser devices and camera, and citizens that report their observations. These techniques, however, are inefficient, labor intensive, and expensive. The goal of this research work is to study the use of currently available low-cost sensors such as GPS, gyroscopes, accelerometer, noise recorders, and cellphones to automate inspection of roadway pavement conditions. The outcome of this research work is expected to reduce inspection cost and enable the capability of generating more frequent maps of roadway pavement conditions. Furthermore, authorities will be able to allocate available funds more efficiently to improve existing road performance and function based on more up-to-date conditions of existing transportation networks.</p>

<p>Describe Implementation of Research Outcomes (or why not implemented)</p> <p>Place Any Photos Here</p>	<p>The research outcomes can be implemented by equipping vehicles, such as police patrols or taxis, with low-cost sensing devices, including GPS and smartphone accelerometers. These sensors continuously collect real-time data on road conditions, detecting anomalies like cracks and potholes. The data is processed using the developed machine learning models to generate detailed maps of road networks, highlighting areas that require maintenance.</p> <p>Additionally, the Mixed-Integer Linear Programming (MILP) model can be integrated into transportation agencies' planning tools. This model helps optimize maintenance and repair (M&R) activities by considering budget constraints and road condition deterioration rates. By implementing these outcomes, municipalities and transportation agencies can move towards proactive, data-driven road maintenance strategies, improving the efficiency of resource allocation, minimizing traffic disruptions, and enhancing road safety. Moreover, this approach allows for more frequent and cost-effective monitoring of road conditions, ultimately extending the longevity of the road network.</p>
<p>Impacts/Benefits of Implementation (actual, not anticipated)</p>	<p>The research offers a low-cost, scalable solution for real-time monitoring of roadway conditions, reducing traditional inspection costs from \$429 per mile to near-zero by utilizing GPS and smartphone sensors in vehicles. By optimizing maintenance schedules through machine learning and MILP models, transportation agencies can improve road safety, extend infrastructure lifespan, and potentially reduce maintenance costs by 20-30%. This proactive, data-driven approach also minimizes traffic disruptions and enhances resource allocation efficiency.</p>
<p>Web Links</p> <ul style="list-style-type: none"> • Reports • Project Website 	<ul style="list-style-type: none"> • MPC Final Report – Studying the Use of Low-Cost Sensing Devices to Report Roadway Pavement Conditions