UTC Project Information		
Project Title	MPC-541 – Assessing Road Conditions for Wyoming County Gravel Roads	
University	University of Wyoming	
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Start and End Dates	November 2, 2017 to July 21, 2022	
Brief Description of Research Project	There are over 1.6 million miles of unpaved roads (53% of all) in the United States. In the state of Wyoming, there are around 12,000 miles of gravel roads maintained by Counties in Wyoming. Though these gravel roads generally serve less traffic, they still need a large portion of the counties' budgets to remain in good enough condition to provide service at levels that are acceptable to the traveling public. The fundamental gravel roads maintenance and management challenges faced by county road departments are to provide service at acceptable levels within an acceptable budget. To tackle these challenges, there is a need to develop a Gravel Road Management System (GRMS).	
	GRMS methodology to manage gravel roads. The GRMS will be applied in Laramie County as a pilot study. Laramie County has more than 1,000 miles of gravel roads and can be considered as the representative county in Wyoming. The proposed GRMS will be	

	responsive primarily to potential increase in future traffic volumes due to industrial activities.
Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	In this study, valuable information and data will be provided to decision-makers and legislatures at the state of Wyoming, such as WYDOT and the Federal Highway Administration. These data and the information will assist the allocation of the funds. The results of this study can help evaluate the gravel roads' network in the state and identify the current practices and, therefore, recommends improvements.
	Accurate detection of dust amounts is very crucial in GRMS. Another expected outcome of this study is this study establishes novel methods for automatic detection and classification of dust amounts on gravel roads by digital image processing techniques. Such methods can assist local agencies in data collection and maintenance planning, as well as help state engineers to classify the dust amount on gravel roads more efficiently and cost-effectively. The ultimate goal of this study is to develop a more rigorous understanding of assessing road conditions for Wyoming county gravel roads and to recommend the most efficient mitigation practices.
Impacts/Benefits of Implementation (actual, not anticipated)	<ol> <li>Develop and implement smartphone applications and technologies to assess the gravel road conditions and performance. This included the continuation of the data collection process.</li> <li>Develop user-friendly tools, to help decision-makers and local agencies in managing gravel roads efficiently. Using these tools, decision-makers will be able to identify the most appropriate treatment type for each road, based on service level, estimated project costs, predicted road conditions, and whether to fund a project or not. The optimization models aim to maximize the overall condition of the gravel roads network subject to the average daily traffic (ADT) on each road.</li> </ol>
Web Links <ul> <li>Reports</li> <li>Project Website</li> </ul>	<ul> <li><u>MPC Research Report</u></li> <li>Journal Article – <u>A Developed Methodology for Determining</u> <u>Gravel Roads' Level of Service: A Case Study of Wyoming</u></li> <li>Journal Article – <u>Validating the Practicality of Utilising an</u> <u>Image Classifier Developed Using TensorFlow Framework in</u> <u>Collecting Corrugation Data from Gravel Roads</u></li> <li>Journal Article – <u>Developing an Optimization Tool for Selecting</u> <u>Gravel Roads Maintenance Strategies Using a Genetic</u> <u>Algorithm</u></li> <li>Journal Article – <u>Image Retraining Using TensorFlow</u> <u>Implementation of the Pretrained Inception-v3 Model for</u> <u>Evaluating Gravel Road Dust</u></li> </ul>

<ul> <li>Journal Article – <u>Developing and Validating an Image</u> <u>Processing Algorithm for Evaluating Gravel Road Dust</u></li> </ul>
<ul> <li>Journal Article – <u>Development of Performance Prediction</u> Models for Gravel Roads Using Markov Chains</li> </ul>
<ul> <li>Journal Article – <u>An Optimisation Tool to Select Gravel Roads</u> for Dust Chemical Treatment Projects Using Genetic <u>Algorithms</u></li> </ul>