

Montana Department of Transportation Maintenance Process Improvements Final Report

By

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Advanced technologies have many potential applications in the transportation field, including improving maintenance operations through the coordination and integration of resources. These technologies offer the potential to conduct more highway work with less human resources, open work zones to traffic in a more expedient manner, provide better service without increasing costs, and increase work zone safety for workers and travelers. In order to pursue these potential benefits, WTI has evaluated technologies that may be beneficial to the maintenance division of the Montana Department of Transportation (MDT).

The purpose of this project was to develop new R&D initiatives for advanced technology applications, while improving MDT's maintenance operations. To facilitate this objective, an extensive literature review was conducted to assess the use of advanced technologies in the maintenance field. WTI created an applications matrix that compares MDT's current maintenance activities with the revised state of the practice from the literature review. The applications matrix was then used as a tool to guide discussions with MDT maintenance personnel and determine target areas for candidate projects and demonstrations.

The following target areas have been established as points of focus from the preliminary evaluation of the applications matrix and meetings with MDT maintenance personnel: Information Gathering and Dissemination Technology, Decision Support Systems, and Inventory Tracking and Control Systems. This analysis will facilitate the development of a proposal for design, implementation, and evaluation of a candidate project. The matrices are listed starting on page 2.

SIGNIFICANCE: This project will not only serve MDT, but also provide valuable state of the practice information to all Departments of Transportation exploring the potential of advanced technology to address maintenance needs.

		Roadside Maintenance Technologies						
		Automated Litter Bag/Debris Collection Vehicle	Automated Roadway Debris VACuum System (ARDVAC)	Laser Graffiti Removal System	Smart Herbicide Applicator	Herbicide Spray Vehicle	Patchen WeedSeeker ®	Precision Offset Spray System for Roadway Shoulder Weed Control
Resource Planning and Management	Possible Application							
	No Similar Tech. In Use							
	Development/Research							
	Evaluating							
	Limited Use							
	Moderate Use							
Roadway Maintenance	Full Integration							
	Possible Application							
	No Similar Tech. In Use							
	Development/Research							
	Evaluating							
	Limited Use							
Roadside Maintenance	Moderate Use							
	Full Integration							
	Possible Application							
	No Similar Tech. In Use							
	Development/Research							
	Evaluating							
Roadway/Roadside	Limited Use							
	Moderate Use							
	Full Integration							
	Possible Application							
	No Similar Tech. In Use							
	Development/Research							
Structure Maintenance	Evaluating							
	Limited Use							
	Moderate Use							
	Full Integration							
	Possible Application							
	No Similar Tech. In Use							
Winter Maintenance	Development/Research							
	Evaluating							
	Limited Use							
	Moderate Use							
	Full Integration							
	Possible Application							
Work Zone Safety and Control	No Similar Tech. In Use							
	Development/Research							
	Evaluating							
	Limited Use							
	Moderate Use							
	Full Integration							

		Work Zone Safety & Traffic Control							
		Automated Highway Cone Placement and Retrieval Vehicle. "Cone Shooter"	Autonomous Sensor-Based Shadow Vehicle	Mobile Traffic Control Systems for Work Zones. Caltrans Mobile Surveillance	Indiana Smart Work Zone	Maryland: Condition Responsive Work Zone Traffic Control Systems	Minnesota: Portable Traffic Management System	Missouri: Portable ITS for Work Zones	Automated Data Acquisition and Processing of Traffic Information.
Resource Planning and Management	Possible Application								
	No Similar Tech. In Use								
	Development/Research								
	Evaluating								
	Limited Use								
	Moderate Use								
	Full Integration								
Roadway Maintenance	Possible Application								
	No Similar Tech. In Use								
	Development/Research								
	Evaluating								
	Limited Use								
	Moderate Use								
	Full Integration								
Roadside Maintenance	Possible Application								
	No Similar Tech. In Use								
	Development/Research								
	Evaluating								
	Limited Use								
	Moderate Use								
	Full Integration								
Roadway/Roadside	Possible Application								
	No Similar Tech. In Use								
	Development/Research								
	Evaluating								
	Limited Use								
	Moderate Use								
	Full Integration								
Structure Maintenance	Possible Application								
	No Similar Tech. In Use								
	Development/Research								
	Evaluating								
	Limited Use								
	Moderate Use								
	Full Integration								
Winter Maintenance	Possible Application								
	No Similar Tech. In Use								
	Development/Research								
	Evaluating								
	Limited Use								
	Moderate Use								
	Full Integration								
Work Zone Safety and Control	Possible Application								
	No Similar Tech. In Use								
	Development/Research								
	Evaluating								
	Limited Use								
	Moderate Use								
	Full Integration								

		Resource Planning and Management							
		Optimizing Work Zone Lengths for Four-Lane Highways	Reliability-Based Life-Cycle Management of Highway Bridges	Computing Fastest Paths in Continuous-Time Dynamic Networks with Piecewise Linear Link Travel-Time Functions	Applying Portable Pen-Based Computers Used In Combining Inputs for Short Run Scheduling	Voice Recognition Systems, Electronic Clipboards, and Hand Held Data Terminal and Barcode Scanner Applied to Daily Work Reporting.	Roadway Feature Inventory Updating Using Pen-Based Systems With Digitized Map Displays.	Cradle to Grave Sign Inventory and Maintenance Management System.	Using Telecom Technology for Transmitting Work Reports to Headquarters in a Non-Verbal form.
Resource Planning and Management	Possible Application								
	No Similar Tech. In Use								
	Development/Research								
	Evaluating								
	Limited Use								
	Moderate Use								
Roadway Maintenance	Full Integration								
	Possible Application								
	No Similar Tech. In Use								
	Development/Research								
	Evaluating								
	Limited Use								
Roadside Maintenance	Moderate Use								
	Full Integration								
	Possible Application								
	No Similar Tech. In Use								
	Development/Research								
	Evaluating								
Roadway/Roadside	Limited Use								
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Structure Maintenance	Evaluating								
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	Full Integration								
	Possible Application								
	No Similar Tech. In Use								
Winter Maintenance	Development/Research								
	Evaluating								
	Limited Use								
	Moderate Use								
	Full Integration								
	Work Zone Safety and Control	Possible Application							
No Similar Tech. In Use									
Development/Research									
Evaluating									
Limited Use									
Moderate Use									
	Full Integration								

		Miscellaneous Technologies					
		Automated Highway System Infrastructure Diagnostic Vehicle	Teleoperated and Automated Maintenance Equipment Robotics (TAMER)	Teleoperated Hazmat Vehicle	Automated System for robotic excavation and pipe installation.	Teleoperated Remote Control Caterpillar Bulldozer and Autonomous Loading System for Repetative Backhoe Operations.	GPS and GIS systems used to reduce the errors in measuring distances from mile posts. (Differential GPS)
Resource Planning and Management	Possible Application						
	No Similar Tech. In Use						
	Development/Research						
	Evaluating						
	Limited Use						
	Moderate Use						
Roadway Maintenance	Full Integration						
	Possible Application						
	No Similar Tech. In Use						
	Development/Research						
	Evaluating						
	Limited Use						
Roadside Maintenance	Moderate Use						
	Full Integration						
	Possible Application						
	No Similar Tech. In Use						
	Development/Research						
	Evaluating						
Roadway/Roadside	Limited Use						
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	Limited Use						
	Moderate Use						
	Full Integration						