

# Research Digest

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## State DOT Reports

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## *Item 1*

### **Reducing Congestion in Denver: A New Approach to Increasing Mobility**

REASON FOUNDATION

• 2015

"This document looks at traffic congestion in Denver. It argues that adhering to the current long-range plan of investing heavily in fixed-rail transit and land-use changes will cause a significant increase in congestion. Instead, the author recommends various solutions including addressing traffic incidents, expanding bus rapid transit and increasing highway capacity through value-priced tolling. It is estimated that the addition of priced lanes would cost \$10.6 billion which could be partially financed based on projected toll revenues and carried out by public private partnerships. The economic benefits and time-saving benefits of implementing this approach are outlined." --TRID

(133 pages)

#### CONTENTS

- [Executive Summary]
- Denver's Congestion Problem and Current Plans
- Lack of Mobility and Its Consequences
- Operations Management
- Principles for Improving Denver's Roadway and Transit Systems
- Managed Lane and Freeway Capacity
- Arterial Highways and Managed Arterials
- Transit
- Funding and Financing
- Costs, Benefits and Structural Issues for Denver's Transportation Improvements
- Conclusion
- Appendix A: Major Primary Arterial Highways Components
- Appendix B: Analysis of Express Toll Lane Additions
- Appendix C: Project Cost Estimates
- Appendix D: Project Revenue Estimates

This report is available for free download (3 MB):

[http://reason.org/files/reducing\\_congestion\\_denver.pdf](http://reason.org/files/reducing_congestion_denver.pdf)

# Research Digest

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## *Item 2*

### **Connected vehicle application roadmap for Oregon as part of preparing a possible Oregon road map for connected vehicle/cooperative systems deployment scenarios: Task 5 Report**

OREGON DEPARTMENT OF TRANSPORTATION

• 2016

The goal of this project was to lay the groundwork for Oregon to be prepared to lead in the implementation of a connected vehicle/cooperative systems transportation portfolio, and/or to avoid being caught by surprise as developments in this area evolve quickly. The project assessed ODOT's internal mechanisms for addressing connected vehicle/cooperative systems, scanned, reviewed and assessed the technical maturity of potential connected vehicle/cooperative system applications, developed preliminary goals, linked to prospective connected vehicle/cooperative systems applications, and refined/ranked/prioritized those that fit with potential ODOT role in advancing/leading these initiatives. The project identified opportunities for linking ODOT's current programs with national and international connected vehicle/cooperative system research, testing and deployment initiatives, and recommended a final shared vision and "road map" for Oregon's priority connected vehicle/cooperative system applications. This volume contains the connected vehicle roadmap for Oregon. Included is a review of the AASHTO connected/automated vehicle research roadmap, and additional context through an update on recent federal transportation initiatives related to connected and automated vehicles. Also included is a review of the ongoing vehicle to infrastructure (V2I) deployment coalition. Other state DOT actions are also summarized; including the AASHTO pooled fund study and work being done in California, Michigan, Texas and Virginia. A spatial analysis of ODOT roadside devices for potential V2I adaptation is also included. The connected vehicle roadmap contains 94 recommended actions under a total of 12 categories: DSRC and Backhaul Communications, Education and Outreach, Policy and Communications/Collaboration, Benefits/Business Case, Data Management and Strategies, Applications, Try Things, Research Questions/Challenges, Planning and Equity, Multimodal, Design and Construction, Operations and Maintenance. Each recommended action is ranked according to its priority, timing and cost. (139 pages)

#### CONTENTS

- Introduction
- CONNECTED/AUTOMATED VEHICLE RESEARCH ROADMAP FOR AASHTO
- CONTEXT: RECENT FEDERAL TRANSPORTATION INITIATIVES
- VEHICLE TO INFRASTRUCTURE (V2I) DEPLOYMENT COALITION
- CONTEXT: STATE DOT ACTIONS
- SPATIAL ANALYSIS OF OREGON ROADSIDE DEVICES FOR POTENTIAL V2I ADAPTATION
- ROADMAP
- REFERENCES

This report is available for free download (14.5 MB):

[http://www.oregon.gov/ODOT/TD/TP\\_RES/ResearchReports/SPR764\\_Task\\_5\\_DevConnectedVehicleApplication\\_050416.pdf](http://www.oregon.gov/ODOT/TD/TP_RES/ResearchReports/SPR764_Task_5_DevConnectedVehicleApplication_050416.pdf)

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## *Item 3*

### **Partnerships for Promoting Pollinator Habitat**

MINNESOTA DEPARTMENT OF TRANSPORTATION (MN/DOT)

• 2016

"MnDOT is interested in learning about the experiences of other state departments of transportation and local agencies in maintaining pollinator landscapes on highway ROWs through partnerships with individuals, groups or local agencies. Of particular interest are the ways in which these programs are developed, managed and funded, and how these efforts may relate to existing roadside maintenance programs such as Adopt-a-Highway and landscape partnership programs. This Transportation Research Synthesis is divided into three sections: Current MnDOT Programs and Practices. Survey of Practice.

Related Resources

(107 pages)

This report is available for free download (12.2 MB):

<http://www.dot.state.mn.us/research/TRS/2016/TRS1601.pdf>

## *Item 4*

### **Alternatives to Seal Coats**

MINNESOTA DEPARTMENT OF TRANSPORTATION (MN/DOT)

• 2016

"The goal of this project was to summarize the current State of the Practice of surface treatment alternatives to seal coats used in the Midwest and to establish a list of products and techniques for Minnesota cities and counties. Braun Intertec has gathered and summarized information from Midwest agencies, contractors, material suppliers and publications to develop guidelines for project, material, and technique selection. The purpose of this Transportation Research Synthesis (TRS) was to summarize current seal coat practices and identify alternatives that provide pavement protection, extend pavement life similar to chip seals, and avoid the identified problems. Other surface treatment techniques used around the country include fog seals, bio seals, sand seals, sandwich seals, slurry seals, and micro surfacing and include many proprietary or brand name products."

(44 pages)

This report is available for free download (273 KB):

<http://www.dot.state.mn.us/research/TRS/2016/TRS1602.pdf>

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*Item 5*

**Quantifying the Impact of Bridge Maintenance Activities on Deterioration: A Survey of Practice and Related Resources**

MINNESOTA DEPARTMENT OF TRANSPORTATION (MN/DOT)

• 2016

"MnDOT is interested in learning about practices to quantify the benefits of various bridge maintenance treatments in relation to remaining service life and bridge life-cycle costs. In addition, the agency is interested in knowing how maintenance treatments may be incorporated into deterioration models. To support this effort, CTC & Associates conducted a literature search and a survey of domestic and international transportation agencies to learn about the type and frequency of bridge maintenance activities, practices for quantifying the impact of bridge maintenance activities on deterioration, and the use of deterioration models to examine the benefits of bridge maintenance."

(81 pages)

This report is available for free download (2.6 MB):

<http://www.dot.state.mn.us/research/TRS/2015/TRS1509.pdf>

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## *Item 6*

### **What affects U.S. Passenger Travel? Current Trends and Future Perspectives**

UNIVERSITY OF CALIFORNIA DAVIS. NATIONAL CENTER FOR  
SUSTAINABLE TRANSPORTATION

• 2016

The United States is going through an era of unprecedented transformation. Socio-demographic changes, major innovations in information technology, the reorganization of economic activities, and substantial shifts in the urban form of cities all contribute to changing the way Americans live, work, and travel. During the past ten years, transportation demand in the United States has also gone through significant modifications. The use of private vehicles has gone through a period of apparent stagnation. Starting in the mid-2000s, the average per-capita vehicle miles traveled (VMT) have declined, at least temporarily (until 2013), after a long period of steady growth in the previous decades. In addition, an increased portion of Americans live without a car. While the total amount of trips in the country continues to rise, this has not translated into increased car use, and the use of alternative modes (including public transportation and active means of travel) is increasing, even if it still accounts for a rather low portion of mode share. Passenger travel in the United States at the beginning of the 21st century is increasingly multimodal, and (slightly) less reliant on the use of private cars. Travelers are changing their behaviors in response to new alternatives available to them, changes in the characteristics of the old alternatives, and changes in the way they evaluate and value these characteristics. A complex combination of factors is behind the observed trends. The economic crisis from 2007-2009 certainly contributed to reducing total VMT in the country. However, it is not the main cause of the observed changes in travel behavior, and other factors seem to play an important role. In particular, several studies have demonstrated how the observed reduction in car travel actually predates the economic crisis by at least a few years.

(vii, 64 pages)

#### CONTENTS

- Introduction
- General Trends in Passenger Travel
- A Framework for Understanding Passenger Travel Demand
- Economic Growth
- Gas Price
- Urban Form
- Sociodemographic Patterns
- Adoption of Technology
- Shared Mobility Services
- Connected and Autonomous Vehicles
- Conclusions: Impact on Future Travel Demand and Knowledge Gaps
- References
- Appendix

This report is available for free download (1.4 MB):

[http://www.dot.ca.gov/research/researchreports/reports/2016/CA16-2825\\_FinalReport.pdf](http://www.dot.ca.gov/research/researchreports/reports/2016/CA16-2825_FinalReport.pdf)

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## *Item 7*

### **Incorporating Driver Behaviors into Connected and Automated Vehicle Simulation**

CENTER FOR ADVANCING TRANSPORTATION LEADERSHIP AND SAFETY (ATLAS CENTER)

• 2016

The adoption of connected vehicle (CV) technology is anticipated at various levels of development and deployment over the next decade. One primary challenge with these new technologies is the lack of platform to enable a robust and reliable evaluation of their benefits given the complexity of interactions among wireless communications, algorithms, and human behaviors. Underlying driver behavior models in microscopic simulation are not always well-suited for modern applications using CV and automated vehicle (AV) technology.

This study proposed a framework for incorporating realistic driver behaviors into a microscopic traffic simulation for AV/CV applications using VISSIM microscopic simulation software. The framework consists of three levels of driver behavior adjustment: event-based, continuous, and semi-automated/automated driver behavior adjustment. The framework provides several examples and details on how various applications can be properly modeled in a traffic simulation environment.

To demonstrate the framework, researchers conducted a case study of a simulation evaluation of cooperative adaptive cruise control (CACC). CACC enables the vehicles to follow each other in a very tight spacing (also known as platooning) using wireless connectivity and automated longitudinal control. The case study shows that a modified driver model can be successfully used in the simulation to evaluate the benefits of AV/CV applications such as CACC with respect to their mobility, safety, and environmental performance.

(104 pages)

This report is available for free download (3.69 MB):

<http://www.atlas-center.org/wp-content/uploads/2014/10/ATLAS-Research-Report-Songchitruksa-ATLAS-2016-13.pdf>

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## **Item 8**

### **Alternative Aggregates and Materials for High Friction Surface Treatments**

TEXAS A&M UNIVERSITY. TEXAS TRANSPORTATION INSTITUTE (TTI)

• 2016

The State of Florida has used high friction surface treatments (HFSTs) since 2006 to reduce wet weather crashes on tight curves and intersections and to maintain bridge decks; however, the Florida Department of Transportation (FDOT) has reported issues related to premature failure of the treatment. The scope of this project was to: (1) Review the literature and interview industry experts on the state of the practice of HFST; (2) Document all existing HFST projects in Florida and analyze their performance based on distress, skid resistance, and crash reduction; (3) Perform field testing on six projects, evaluating their present performance and conducting forensic analyses as needed; (4) Perform laboratory tests on different aspects of HFST materials and construction practices to improve durability and reduce costs; and (5) Develop a revised HFST specification for Florida and an HFST Guidelines booklet. The research findings include historic costs, project performance histories, identification of failure mechanisms, crash rate reductions for various applications, benefit-cost analyses, trends between aggregate loss and both resin binder type and mil thickness, thermal compatibility measurements, resin binder gel times under non-ideal situations, an HMA design using calcined bauxite, and comparisons of a few high friction aggregates. The researchers recommended many ways to improve the design, construction, and quality control of HFST. These are reflected in the proposed specification Section 333. A new user-friendly booklet, titled “High Friction Surface Treatment Guidelines: Project Selection, Materials, and Construction,” was created to assist contractors and FDOT inspectors to implement the new specification.

(159 pages)

This report is available for free download (9.8 MB):

[http://www.dot.state.fl.us/research-center/Completed\\_Proj/Summary\\_SMO/FDOT-BDR74-977-05-rpt.pdf](http://www.dot.state.fl.us/research-center/Completed_Proj/Summary_SMO/FDOT-BDR74-977-05-rpt.pdf)

## **Item 9**

### **Two-Lane Rural Highways Safety Performance Functions: Final Report**

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION (WSDOT)

• 2016

This report documents findings from a comprehensive set of safety performance functions developed for the entire state two-lane rural highway system in Washington. The findings indicate that random parameter models and heterogeneous negative binomial models with dispersion parameter models as functions of roadside variables are effective in capturing the simultaneous impact of roadway and roadside geometrics on two-lane rural roadway safety performance. This study underscores the importance and utility of roadside data inventories in safety performance function development.

(406 pages)

This report is available for free download (7.9 MB):

<http://www.wsdot.wa.gov/research/reports/fullreports/856.1.pdf>



# Research Digest

## *Item 10*

### **Evaluation of Warm Mix Technologies for Use in Asphalt Rubber: Asphaltic Concrete Friction Courses (AR-ACFC)**

ARIZONA DEPARTMENT OF TRANSPORTATION (AZ DOT)  
2016-631 • 2016

The objective of this research project was to determine whether warm mix asphalt (WMA) technologies can be used by the Arizona Department of Transportation (ADOT) for the production of an asphalt rubber-asphaltic concrete friction course (AR-ACFC) without detrimental effects on performance of the pavement. The study consisted of a laboratory study and the monitoring of a field construction project. Three ADOT-approved warm mix additives (Evotherm, Sasobit, and Advera) were investigated. The study showed that when the additives were used at the manufacturer's suggested target dosage level there was no negative impact on the durability or the moisture susceptibility of the AR-ACFC as compared to the control (no additive) mix. The field study confirmed that the use of WMA technologies during AR-ACFC construction is feasible with no adverse effects on paving operations.  
(104 pages)

This report is available for free download (6 MB):

[http://apps.azdot.gov/ADOTLibrary/publications/project\\_reports/PDF/SPR631.pdf](http://apps.azdot.gov/ADOTLibrary/publications/project_reports/PDF/SPR631.pdf)

## *Item 11*

### **Creating Multi-Use Highway Structures with Retrofitted Fencing to Reduce Collisions with Elk on Interstate 17**

ARIZONA DEPARTMENT OF TRANSPORTATION (AZ DOT)  
2016-689 • 2016

In Arizona, vehicle collisions with elk are costly and can be deadly. Dedicated wildlife crossing structures have proven effective for elk elsewhere in Arizona. Planned highway reconstruction for Interstate 17 (I-17) included such wildlife crossing structures, but when construction was delayed, an alternative was developed: extending the height of right-of-way (ROW) fencing to funnel wildlife underneath existing highway bridges and overpasses. After 5.9 mi of ROW fencing (between mileposts 316.8 and 322.7) was extended to 8 ft high, this study evaluated its effectiveness in guiding elk to cross under two large bridges and the overpass and underpass of two traffic interchanges (TIs).

Following the fencing retrofit, researchers documented a 97.5 percent reduction in elk-vehicle collisions and an 88.9 percent decrease in crashes coded "Animal\_Wild\_Game" by the Arizona Department of Public Safety (DPS) along the 5.9-mi segment of I-17. No increase in collisions was reported within the 1-mi fence end segments or control areas. The researchers documented 217 percent and 54 percent increases in elk crossing under the Munds Canyon and Woods Canyon bridges, respectively, but no elk use of the modified TIs (Fox Ranch Road and Schnebly Hill Road). Following the retrofit, fence maintenance costs did not increase or exceed those of adjacent sections. Using the Huijser et al. (2009) estimated cost of \$17,483 per elk-vehicle collision, the documented level of collision reduction will recoup retrofitting costs in less than five years. The findings indicate that fencing retrofits can reduce wildlife-vehicle collisions if given appropriate circumstances, such as adequate size and spacing of existing highway structures.  
(70 pages)

This report is available for free download:

[http://apps.azdot.gov/ADOTLibrary/publications/project\\_reports/pdf/SPR689.pdf](http://apps.azdot.gov/ADOTLibrary/publications/project_reports/pdf/SPR689.pdf)

# Research Digest

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## *Item 12*

### **Potential impacts of solar arrays on highway environment, safety and operations**

COLORADO DEPARTMENT OF TRANSPORTATION. DTD APPLIED RESEARCH AND INNOVATION BRANCH  
*CDOT-2015-08 • 2015*

The advent of solar energy utilization in highway infrastructure around the country has been increasing in recent years. Right of Ways (ROWs) have several advantages for energy development such as the existing electrical infrastructure aligned with the major highways, a secured boundary, and easy maintenance access. It has been identified by various Departments of Transportation (DOTs) and the Federal Highway Administration (FHWA) that solar array deployment along the ROW is possible after adequate site evaluation and impact study. With higher solar insolation available, CDOT can generate electricity from solar arrays on its ROWs across much of the State of Colorado. Political climate, public cooperation with energy providers, commitment of utility companies and potential impacts are some of the major concerns in successful solar array deployment. The potential impact of photo voltaic (PV) arrays on driver safety, highway operation and maintenance, and the environment are the focus of this research study. Changes in driver's expectations, glare, maintenance practices due to snow drifting along the roadside, and local ecosystems are some of the impacts that are evaluated in this report.

To understand the potential impacts on driver safety, environmental resources, and maintenance operations, case studies are presented from national and international projects. A base line study was performed pertaining to the current ROW's physical characteristics, operational conditions, regulatory requirements and PV array design criteria. Factors associated risk impacts are analyzed qualitatively as well as quantitatively. Mitigation measures are recommended to minimize the undesirable impacts in the planning, design, construction, operation and maintenance of solar array. This document provides guidance for CDOT Management, Project Engineers, Operation and Maintenance personnel and energy generators who are interested in installing and maintaining PV arrays in the CDOT ROW.

(93 pages)

This report is available for free download (3.2 MB):

[https://www.codot.gov/programs/research/pdfs/2015-research-reports/solar-arrays/at\\_download/file](https://www.codot.gov/programs/research/pdfs/2015-research-reports/solar-arrays/at_download/file)

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## *Item 13*

### **Work Zone Simulator Analysis: Driver Performance and Acceptance of Alternate Merge Sign Configurations**

MISSOURI DEPARTMENT OF TRANSPORTATION (MODOT)

*cmr 16-014 • 2016*

Improving work zone road safety is an issue of great interest due to the high number of crashes observed in work zones. Departments of Transportation (DOTs) use a variety of methods to inform drivers of upcoming work zones. One method used by DOTs is work zone signage configuration. It is necessary to evaluate the efficiency of different configurations, by law, before implementation of new signage designs that deviate from national standards. This research presents a driving simulator based study, funded by the Missouri Department of Transportation (MoDOT) that evaluates a driver's response to work zone sign configurations. This study has compared the Conventional Lane Merge (CLM) configurations against MoDOT's alternate configurations. Study participants within target populations, chosen to represent a range of Missouri drivers, have attempted four work zone configurations, as part of a driving simulator experience. The test scenarios simulated both right and left work zone lane closures for both the CLM and MoDOT alternatives. Travel time was measured against demographic characteristics of test driver populations. Statistical data analysis was used to investigate the effectiveness of different configurations employed in the study. The results of this study were compared to results from a previous MoDOT to compare result of field and simulation study about MoDOT's alternate configurations. (99 pages)

This report is available for free download (3 MB):

<https://library.modot.mo.gov/RDT/reports/TR201512/cmr16-014.pdf>

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## *Item 14*

### **Evaluation of Erosion Control Blanket Properties and Test Criteria for Specification and Design**

MISSOURI DEPARTMENT OF TRANSPORTATION (MODOT). CONSTRUCTION AND MATERIALS DIVISION

*cmr 16-016 • 2016*

A research project to investigate the product approval, design process, and ongoing product evaluation of erosion control blankets (ECBs) for the Missouri Department of Transportation (MoDOT) was conducted. An overview of federal and state environmental construction laws was performed noting the significance of ECBs on construction sites. Standardized erosion control testing, product approval, and design processes utilized by other state departments of transportation and those recommended by the National Transportation Product Evaluation Program were researched for further insight to typical ECB applications. A field investigation was established to study the effectiveness of two ECBs on a MoDOT construction site. MoDOT completed construction sites, which utilized ECBs, were also included in the investigation to evaluate how well vegetation was sustained and ongoing blanket degradation following site acceptance in accordance with the MoDOT Storm Water Pollution Prevention Plan (SWPPP). In addition to field site evaluations, surveys were developed and administered to record contractor and MoDOT employee ECB experiences and identify common problems and successful practices using ECBs. Recommendations for ECB approval procedures and a design process for conditions representative of Missouri were developed using insight gained through the study of common ECB product acceptance and design, the field site investigation, evaluation of completed construction sites, and the surveys of ECB experiences. The National Transportation Product Evaluation program's (NTPEP) ASTM standardized testing was recommended as the basis for product approval. For ECB design, the Revised Universal Soil Loss Equation (RUSLE) was recommended and used to establish minimum performance requirements for both product acceptance and design. Digital maps were developed using ArcGIS for Missouri's representative hydrologic and geologic conditions for use in the RUSLE. The ECB approval procedures and design process, which were developed specifically for the state of Missouri, are recommended for implementation into the MoDOT Engineering Policy Guide (EPG). An ongoing product evaluation system was also developed for ECBs to document field performance and assist in identifying ECBs that should be removed from the approved products list.

(164 pages)

This report is available for free download (5.1 MB):

<https://library.modot.mo.gov/RDT/reports/TR201509/cmr16-016.pdf>

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## *Item 15*

### **Exploring Corridor Operations in the Vicinity of a Diverging Diamond Interchange (DDI)**

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION (NCDOT). RESEARCH AND ANALYSIS GROUP

*FHWA/NC/2014-13 • 2016*

This research effort examined the corridor impacts of various signal timing and geometric strategies to improve the operational challenges observed at DDIs. A microsimulation analysis was conducted using a calibrated and validated DDI modeled after the National Avenue and US-60 interchange in Springfield, Missouri. Four heavy volume scenarios were tested in combination with seven categories of strategies. These strategies were selected from a larger pool of strategies under the guidance of the NCDOT research panel and national expert recommendations. In addition to the microsimulation effort, a cost analysis was conducted for the same strategies. Considerations were made for implementation cost, disruption to user during implementation, and crash modification impacts. Finally, three sites in North Carolina were selected for field study. In the microsimulation analysis, those strategies which reduced the number of phases at the downstream adjacent intersection had the greatest benefit on the corridor routes for all four heavy volume scenarios. The reduction in phases reduced loss time and increased capacity for the intersection. Unfortunately, these strategies were also the most expensive alternatives studied, were likely to be the most disruptive to users during implementation.

(145 pages)

This report is available for free download (14.9 MB):

<https://connect.ncdot.gov/projects/planning/RNAProjDocs/NCDOT%202014-13%20Final%20Report.pdf>

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## *Item 16*

### **Minimum Virgin Binder Limits in Recycled Superpave Mixes in Kansas**

KANSAS DEPARTMENT OF TRANSPORTATION (KDOT)

*KSU-2013-05 • 2016*

Use of recycled materials in asphalt pavement has become widespread recently due to rising costs of virgin binder and increased attention to sustainability. Historically, recycled asphalt pavement (RAP) has been the most commonly used recycled material for hot-mix asphalt (HMA). However, recycled asphalt shingle (RAS), another recycled material, has recently become popular. Although there are some guidelines regarding use of RAP and RAS in HMA, their effects on mixture performance, especially on mixtures containing RAS, are not thoroughly understood.

In this research, three recycled Superpave (SR) mixture designs from the Kansas Department of Transportation (KDOT) with 9.5-mm (SR-9.5A) and 19-mm (SR-19A) nominal maximum aggregate size (NMAS) were selected as control mixtures. Mixtures containing higher percentages of recycled materials (RAP and RAS) were developed using KDOT blending charts. A total of nine mixtures with varying virgin binder contents were designed and assessed for moisture susceptibility, rutting resistance, and fatigue cracking propensity using modified Lottman, Hamburg Wheel Tracking Device, flow number, Dynamic Modulus, and S-VECD direct tension fatigue tests. Results confirmed the effect of NMAS and material source on mixture performance. For SR-9.5A, the mixtures showed increased susceptibility to moisture and rutting damage below virgin binder content of 75%. For SR-19A, mixtures with virgin binder content of 70% showed satisfactory performance properties. Mixtures with virgin binder contents lower than 60% definitely showed inferior performance.

(120 pages)

This report is available for free download (3.48 MB):

<http://dmsweb.ksdot.org/AppNetProd/docpop/docpop.aspx?clienttype=html&docid=9622548>

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## *Item 17*

### **A study of how unmanned aircraft systems can support the Kansas Department of Transportation's efforts to improve efficiency, safety, and cost reduction**

KANSAS DEPARTMENT OF TRANSPORTATION (KDOT)

*KSU-2014-03 • 2016*

Regulations for using Unmanned Aircraft Systems (UAS) are not yet standardized by the Federal Aviation Administration (FAA). This creates tedious obstacles for those who wish to utilize the technology. The goal of this research is to provide a justified recommendation to the Kansas Department of Transportation (KDOT) on whether or not it is beneficial to implement UAS into routine operations, as well as advice on specific UAS equipment that best fits the needs of KDOT. This report includes a literature review which lists the commercial companies currently using UASs after gaining a Certificate of Authorization (COA) exemption and research done by other DOTs. Potential applications of and concerns about UAS usage are also included in the literature review. Please note that in the literature review, the term UAS and unmanned aerial vehicles (UAV) are used interchangeably since the terms vary within each source. A survey was created and sent to all state Department of Transportation offices. A SWOT (Strengths, Weaknesses, Opportunities, and Threats/Challenges) Analysis was carried out looking at different areas of interest for KDOT. Based on the literature review, survey responses, and SWOT analysis, the use of a UAS for KDOT's operations will improve safety, efficiency, and possibly reduce costs. Out of the nine areas considered for implementing UAS, seven could realize benefits in safety, efficiency, and a possible cost savings. The recommended UAS applications are in bridge inspection, radio tower inspection, surveying, road mapping, high-mast light tower inspection, stockpile measurement, and aerial photography. While UAS cannot replace many of the current activities that KDOT performs, it could greatly enhance them both from a safety and technical point of view.

(105 pages)

This report is available for free download (2.3 MB):

<http://dmsweb.ksdot.org/AppNetProd/docpop/docpop.aspx?clienttype=html&docid=9649165>

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## *Item 18*

### **Mississippi Department of Transportation Research Peer Exchange 2015**

MISSISSIPPI DEPARTMENT OF TRANSPORTATION (DOT)

*MS-DOT-RD-16-267 • 2015*

From October 20th to 22nd, 2015, the Mississippi Department of Transportation, with the assistance of The University of Southern Mississippi, hosted a peer exchange focusing on best practices. The goal of the peer exchange was to develop actionable recommendations for: 1- Research project result implementation, 2- Strategic research plan and 3- Doing more with less. Representatives from four state DOTs (Maryland, Missouri, South Dakota and Montana), the Transportation Research Board (TRB), Federal Highway Administration (FHWA), and the University of Southern Mississippi (facilitator) participated in the peer exchange, which was held in Biloxi, Mississippi.

(v, 37 pages)

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- I. Introduction
- II. Research Program of the Mississippi DOT (MDOT)
- III. Participant Takeaways / Shareable Practices
- Appendix A - Agenda
- Appendix B - Participants
- Appendix C - Code of Federal Regulation (CFR) – Part 420

This report is available for free download (1.5 MB):

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# Research Digest

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## *Item 19*

### **Unmanned aerial vehicle bridge inspection demonstration project**

MINNESOTA DEPARTMENT OF TRANSPORTATION (MN/DOT). RESEARCH SERVICES & LIBRARY

*RC 2015-40 • 2015*

The increasing costs of bridge inspections are a concern for the Minnesota Department of Transportation (MnDOT). The use of Unmanned Aerial Vehicles (UAV) may help alleviate these costs and improve the quality of bridge inspections. The overall goal of the UAV Bridge Inspection Demonstration Project was to study the effectiveness of utilizing UAV technology as it could apply to bridge safety inspections. The project team investigated the technology on four bridges located throughout Minnesota. The project team evaluated the UAVs effectiveness as it could apply to bridge inspections based on UAV field results. Various UAV capabilities were utilized to evaluate current technologies as they relate to use in bridge inspections. This study details the advantages and challenges of potentially using UAVs to aid in bridge inspection, an analysis of current and future UAV technologies as they relate to bridge inspection, and an analysis describing how current and future technologies adhere to the National Bridge Inspection Standards (214 pages in various pagings)

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- Chapter 1: Introduction
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- Chapter 4: Assessment of Current and Future UAV Technology
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- References
- Appendix A - Bridge Investigation and Safety Plan
- Appendix B - UAV Product Information
- Appendix C - NTSB UAS Events Spreadsheet

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<http://www.dot.state.mn.us/research/TS/2015/201540.pdf>