RESEARCH
Makes the Difference 2018

AWARD-WINNING INNOVATIONS FROM STATE DOTS

SMART MAINTENANCE AND PRESERVATION

MONTANA ADDRESSES ROCKFALL HAZARDS THROUGH PRESERVATION

Montana DOT saw success with its Rockfall Hazard Rating System developed in the early 2000s. However, after a decade of use, the system needed to incorporate technical updates, new project selection tools, and asset management principles. Researchers updated the state’s rock slope rating criteria and identified critical rockfall sites in Montana. A new Rock Slope Asset Management Program includes a condition rating scale based on rockfall history and ditch effectiveness, as well as new descriptive condition states to aid with deterioration modeling and risk analysis. Programmatic costs, performance measures, and long-term risks all factor into slope preservation planning tools that focus on maintaining the network rather than reactive repair efforts. Using this approach, the agency has reduced costs from $35 million to $28 million annually while achieving the same outcomes. Final report.

SOUTH CAROLINA ADDS LIFE TO ASPHALT ROADS

A cornerstone goal of South Carolina DOT’s 2018-2020 strategic plan is to “maintain and preserve [the] existing transportation infrastructure.” To help achieve this goal, the agency created a targeted approach to place the right treatment on the right asphalt roads at the right time. Researchers identified several ways to enhance the effectiveness of South Carolina’s existing pavement preservation program: a decision concept that stressed remaining service life, better assessment of treatment options that takes costs and benefits into account, and more educational opportunities for decision makers. Implementation efforts are now underway, with a detailed analysis of various roadway treatments—chip seals, microsurfacing, and ultra-thin lift overlays—that will feed into and improve the agency’s pavement management system and decision-making tools. Final report.

SNOWPLOW ROUTE OPTIMIZATION SAVES MONEY IN KENTUCKY

With the growth of Kentucky’s transportation system, the state’s snow and ice removal routes changed piece by piece. Researchers employed geographic information system–based analytical tools to identify optimal truck routings and to indicate where more or fewer trucks were needed based on collected data and input from local drivers. Using factors such as salt availability, truck types, and roadway attributes, the model produced new optimized route assignments that still prioritized central high-volume roads. Modeling new routes for selected counties has identified the ways to schedule fewer trucks and save significant dollars while keeping Kentucky’s roads clear of snow and ice. Project web page.

The “Sweet Sixteen” state research projects highlighted on these pages were selected by the Research Advisory Committee of the American Association of State Highway and Transportation Officials (AASHTO). They comprise four high-value research projects from each of the four AASHTO regions, funded primarily through the State Planning and Research (SPR) Program.

As the nation’s cornerstone state research program, SPR provides Federal Highway Administration (FHWA) funding to the states to address top concerns and identify solutions at the state level. States further address areas of common concern through the Transportation Pooled Fund Program.

Complementing this publication are two companion pieces for 2018 focusing on research innovations in the areas of safety and pavements. All of these publications may be found at research.transportation.org.
SMART MAINTENANCE AND PRESERVATION (CONTINUED)

NEW HAMPSHIRE MINIMIZES IMPACT OF LIGHTLY CONTAMINATED SOILS
Roadside soils and street wastes (ditching materials, catch basin cleanouts, and street sweepings) have limited reuse potential due to the presence of metals and manmade contaminants related to transportation corridor uses. New Hampshire Department of Environmental Services (NHDES) classifies this impacted soil material as solid waste when it is excavated during construction or collected during maintenance operations. New Hampshire DOT creates significant amounts of this soil material during routine construction projects and maintenance efforts. Disposing of this material in solid waste facilities creates environmental impacts through the continuous landfill disposal of soil resources, as well as significant financial impacts to the state. New Hampshire DOT and NHDES drew upon research to develop a waiver process that allows efficient, prioritized, and restricted reuse of these materials within the transportation corridor where they were produced. This statewide approach reduces unnecessary labor and consultant costs for both agencies while better protecting human health and the environment by promoting limited exposure, handling, transportation, and reuse of these materials. Project web page.

MICHIGAN’S BRIDGE INSPECTION APP ENABLES VIRTUAL DATA COLLECTION
Michigan DOT has taken advantage of new technologies to meet new bridge data-collection requirements from FHWA and AASHTO. Researchers developed 3D BRIDGE, a mobile software app that enables bridge inspectors to collect and record element-level bridge inspection data using wireless tablet devices. The app renders a 3-D model of a bridge using data from Michigan DOT’s bridge management database. Then, through a set of intuitive navigational views, it lets the user “traverse” the bridge and mark the surface with location-specific defect information, photos, and comments. Beyond helping Michigan DOT collect required location-specific data on defects, the app will help advance the agency’s bridge deterioration modeling efforts as well as its bridge management and maintenance programs. Final report.

STRATEGIC PLANNING AND ADVANCED OPERATIONS

DIGITAL PROJECT MANAGEMENT SAVES CONNECTICUT TIME AND MONEY
The prospect of using ProjectWise™ software to go digital with project paperwork gave Connecticut DOT an opportunity to improve design quality, reduce the time needed to access plan archives, and manage engineering documents and drawings more efficiently. Research helped launch a digital design environment that encompasses electronic document generation, management, signatures, project advertisement, and support services. The standardized digital platform—at once secure and efficient—reduces project costs for Connecticut DOT, decreases project development times, and increases accountability within the agency and among consulting engineers. The success of the digital design environment project has opened the door for Connecticut DOT to move forward with other advanced digital initiatives like e-construction, 3-D modeling, and civil integrated management. Final report.

COMMUNICATING WITH THE PUBLIC EASES PLANNING IN TENNESSEE
Too often in the past, public participation in Tennessee DOT planning efforts came from a small but vocal opposition, which commonly distorted a project’s broad public support. The agency aimed to involve a wider cross section of people in public meetings to provide balanced input to the transportation decision-making processes. Building on stakeholder interviews and surveys, researchers developed a database of community partners, held focus groups with key organizations, and conducted an engagement workshop with Tennessee DOT staff. They found that improvements in awareness and two-way dialogue were the two keys to increasing effectiveness of public participation activities. The research is paying off: The agency credits this new culture of communication with easing the passage of a major fuel tax in 2017. Research paper.

DIGITAL MANAGEMENT AIDS GEOTECHNICAL EXPLORATION IN MARYLAND
In the past, Maryland DOT State Highway Administration managed its geotechnical data on paper, resulting in inefficiencies from transcription errors and data inaccessibility that cost the agency time and money. The agency developed a geographic information system–based drilling database to help Maryland better record, track, analyze, and share geotechnical subsurface data. The drilling request feature electronically consolidates and tracks correspondence, right-of-way, and other roadway assets. The database tool also identifies geologic features (estimated depth to rock, wetlands, and flood plains) and automatically provides historic drilling and lab data to avoid duplicate drilling. The system makes real-time drilling information available to project engineers, and automated tracking eliminates the time burden for preparing progress reports and status updates. Savings from electronic data requests, remote data capture, project tracking, and historic boring data total nearly $1 million a year. Research summary.
INDIANA SURFACE TREATMENTS IMPROVE FRICTION AND REDUCE CRASHES

Friction keeps tires from slipping, and diminished pavement friction contributes to crashes. Indiana DOT took a research-based approach both to improve roadway friction through surface treatments and to determine the impact of friction on safety. Lab and field tests of high friction surface treatments (HFSTs) revealed expected performance over time with respect to texture, material loss, and impact from snowplows. Ultimately, HFSTs proved to be an effective method to restore highway friction. Other treatments evaluated and modeled for friction over time included chip seals, microsurfacing, ultra-thin bonded wearing courses, and diamond grinding. Putting these findings in the context of safety, researchers correlated friction and crash data to determine how treatments influence crash modification factors on specific roadway segments. Final report.

NEW SPECS MAKE WISCONSIN PAVEMENTS MORE DURABLE

Aging asphalt pavements commonly suffer from raveling and surface-initiated cracking, resulting in rough, crumbling driving surfaces. Wisconsin DOT is addressing these durability challenges at the mix design stage. Researchers investigated the interplay between mix properties and their impacts on pavement durability, and verified the findings through field tests of mixes sampled from asphalt plants. Wisconsin DOT used these findings to modify its asphalt mix specifications. These modifications are expected to increase pavement life span by two or more years and result in significant annual cost savings. Final report.

STORMWATER MANAGEMENT PREVENTS RUNOFF IN PENNSYLVANIA

In a Pennsylvania DOT research study, rain gardens were constructed alongside the Interstate 95 (I-95) Girard Avenue Interchange to evaluate the stormwater management and maintenance needs of different soils, materials, and bioswale designs. This pilot study examined how rain gardens can accommodate the volume of stormwater runoff for a single storm and subsequent storm events. Investigators used monitoring wells, established baseline conditions for groundwater and soils, and determined variations in storage capacity—all while evaluating plant health and vegetative conditions. This effort provided Pennsylvania DOT with an empirical basis for making more economic proposals for stormwater management, incorporating rain gardens into designs rather than using large and costly detention basins. The agency plans to apply these results to future construction phases of I-95. Final report.

IMPROVED RAINFALL MODEL HELPS NEVADA RIGHT-SIZE DRAINAGE

Having realistic expectations for rainfall is a critical step in designing drainage infrastructure. While too little drainage capacity can mean runoff that is harmful to the environment and damaging to roadways, excess capacity can be an extreme cost burden. Nevada DOT undertook a detailed analysis of rainfall in the state, examining variations both by region and time of rainfall events. The improved understanding of Nevada rainfall in eight meteorological zones pointed to an overall reduction in estimates of stormwater peak flows and volumes compared with values traditionally used by Nevada DOT. Agency hydraulic engineers will use these results to appropriately size drainage infrastructure on projects, with an expectation of reduced costs—both initial and life-cycle—without sacrificing level of service. Final report.

UPGRADING HYDROLOGIC DESIGN STANDARDS COULD MEAN AN AVERAGE SAVINGS OF $3 MILLION
SAFER HIGHWAYS AND WORK ZONES

FLORIDA PEDESTRIAN AND BICYCLIST COUNTERMEASURES SAVE LIVES

Florida DOT saw a need to improve pedestrian and bicyclist safety, particularly in low-income areas with higher pedestrian hazards. Researchers identified the factors that affect pedestrian crash frequency and injury severity—looking not only at crash data but also demographics and social factors, the road environment, and land use—and quantified their relationships and degree of impact. Recommendations included engineering countermeasures along with pedestrian safety education and outreach tailored to regional demographics. Florida DOT’s central and district offices worked with local agencies and safety coalitions to implement such countermeasures as improved roadway lighting, midblock crossings, bus stop improvements, high-visibility enforcement, and a variety of educational and social media efforts. This work is paying dividends in safety, with reductions in both pedestrian and bicyclist fatalities. Final report.

IOWA’S SMARTPHONE APP DELIVERS LIFE-SAVING INFORMATION

Every minute counts when a hospital trauma team prepares for victims of a highway crash, and advance details—patient condition, crash severity, vehicle intrusion patterns, and other visual information—are critical. Iowa DOT worked to provide precious extra minutes through development of a smartphone app for fast, direct communication between first responders and emergency room staff. In trials around Iowa City, the TraumaHawk app let Iowa State Patrol troopers and life support paramedics collect highly specific photos of crashed vehicles. The TraumaHawk system automatically sends these images to emergency room personnel and announces them with an alarm notification. This research project also developed training that helped law enforcement and first responders record photographic evidence at the scene and emergency room personnel interpret the visual information. Project web page.

COORDINATED STRATEGIES HELP WYOMING REDUCE TRUCK CRASHES

Heavy traffic on Interstate 80, severe weather conditions, and other factors contribute to Wyoming’s high crash rates for large trucks. Wyoming DOT and its partners—the Wyoming Highway Patrol and the Wyoming trucking industry—sought mitigation strategies to reduce the rate of truck crashes. Researchers compiled and analyzed data related to crashes, traffic volume, highway geometry, citations, and enforcement activity from Interstate and selected state highways in Wyoming. Newly identified hot spots of truck crashes and driver citations along with best practices from other states helped determine new mitigation strategies. Recommendations for each of the statewide partners will help drive down truck crashes. These recommendations include countermeasures (variable speed limits, rumble strips, and other techniques) for Wyoming DOT, targeted enforcement activities for the Wyoming Highway Patrol, and safety training and education tools for the trucking industry. Final report.

UTAH ROLLS FORECASTING INTO NEW HIGHWAY SAFETY MODEL

Utah DOT’s traditional safety index is a metric that planners can use for prioritizing new highway projects, but its reliance on historical crash data limits its usefulness. Researchers formulated a new index based on safety forecast modeling, drawing from performance function and crash modification factor principles in AASHTO’s Highway Safety Manual. The agency’s highway database, crash data, and forecasts for traffic volume and lanes all fed into the new safety forecast model. By applying the model to 15 long-range road-widening projects, researchers identified those most likely to experience improvements in safety. Beyond long-range planning, Utah DOT aims to use the model to perform systemwide analyses, identifying common conditions across the state that contribute to serious crashes. Final report.

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COUNTERMEASURES

LED TO AN 8 PERCENT DROP IN PEDESTRIAN FATALITIES AND A 21 PERCENT DROP IN BICYCLIST FATALITIES.

American Association of State Highway and Transportation Officials

Access the electronic edition of this document with project links, as well as more high-value state DOT research projects, at AASHTO’s research website, research.transportation.org.