Research Makes the Difference 2012

Innovation Advances Transportation

Research and innovation enable state transportation departments to deliver safer, smarter, and more efficient transportation systems. The projects on these pages, funded primarily through the national programs below, are a few among many that exemplify the high return on transportation research investments.

The State Planning and Research Program. As the nation’s cornerstone state research program, SPR provides federal aid 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.

The National Cooperative Highway Research Program. State DOTs continue to commit SPR funding to support and oversee NCHRP, which pools research dollars to find solutions to transportation challenges identified as critical by the states.

The U.S. Department of Transportation. Research conducted through the Federal Highway Administration and other U.S. DOT channels allows the government to tackle high-priority needs and share new technologies and practices with the states.

BUILDING LONGER-LASTING ROADS AND BRIDGES

FHWA AND DOTS EXTEND BRIDGE DESIGN

Transportation agencies are constantly seeking new methods to build better bridges. FHWA is leading a nationwide effort to help states incorporate ultra-high performance concrete—or UHPC—into highway bridge construction, bringing together a state-of-the-art material with accelerated construction techniques. FHWA research developed the design of simplified field connections to facilitate increased use of prefabricated UHPC components. Since 2009, six bridges in the United States have been constructed using field-cast UHPC connections that enable rapid completion of on-site activities, saving time and money. More than a dozen additional bridges are moving toward construction in 2012. In addition to advancing new materials and techniques, bridge research also helps refine time-tested practices. In Colorado, researchers investigated ways to improve steel bridge design using traditional materials. Colorado DOT will use the research results, which include software and design tables for different bridge widths and span configurations, to optimize steel bridge designs and minimize costs without sacrificing safety.

KENTUCKY AIMS RADAR ON TUNNEL REPAIR

Persistent settling of concrete pavement in the Cumberland Gap Tunnel has led to multiple repair attempts in the past decade. The Kentucky Transportation Cabinet conducted a research program to determine the best long-term repair strategies. Employing ground penetrating radar surveying and hydro-geochemical water testing, investigators were able to establish the root cause of the subbase erosion and propose an appropriate subbase and surface replacement program. Moreover, using the same ground penetrating radar techniques to target repairs to problem areas, the agency was able to cut its repair budget in half—a savings to the public of $5 million.

“Research implementation is a top priority for all states. At every step, we’re thinking about turning research results into tangible benefits, such as improved processes, lower costs, and faster delivery times.”

Rick Land
Chief Engineer, California DOT, and Vice Chair, AASHTO Highway Subcommittee on Design
SAFER HIGHWAYS AND WORK ZONES

PROOF POSITIVE FOR CENTERLINE RUMBLE STRIPS IN KANSAS

Backed by NCHRP research and numerous state studies, DOTs have installed thousands of miles of centerline rumble strips in the United States. The safety benefits of centerline rumble strips in reducing head-on collisions—particularly on high-speed rural highways—are significant. Yet lingering public concern about possible drawbacks to this safety feature, such as excessive exterior noise and the impacts of the rumble strips on centerline visibility, led Kansas DOT to conduct a series of targeted research studies. Investigators established guidelines for measuring retroreflectivity and determining critical distances for nuisance noise. These concerns all proved minor and manageable, and were shown to be far outweighed by the safety benefits. Researchers project that installing centerline rumble strips on rural two-lane highways can reduce total collisions by 50 percent and head-on collisions by almost 90 percent.

TEXAS REMOVES FLAGGERS FROM HARM’S WAY

More than half of fatal injuries to road construction workers are caused by vehicles. Automatic flagger devices are a promising safety countermeasure, reducing workers’ direct exposure to vehicles while still allowing human oversight of traffic control. Texas DOT conducted critical research to determine the effectiveness of these devices. The study measured how well drivers understood and responded to various types of automated flagger devices, including configurations with reversible “stop/slow” signs, red/yellow traffic lights, and railroad crossing-style gate arms. The research showed that automated flagger devices equipped with both traffic lights and a gate arm were highly effective, with a 98 percent rate of driver compliance. Remote operator attendants served as reliable backup to prevent violators from encroaching into work zones. Suggested technical improvements and outreach strategies presented in the study provide a path forward for Texas’ wider deployment of this construction control device.

NATIONAL ROUNDABOUT GUIDANCE FROM NCHRP

States are moving swiftly to implement roundabouts for their demonstrated safety and operational benefits, and NCHRP has taken the lead role in conducting research to support wider deployment of roundabouts. One NCHRP project established an inventory of roundabouts in the United States and developed models for quantifying and predicting roundabout benefits. A study of 55 intersections converted to roundabouts revealed a 35 percent reduction in crashes on average and 76 percent fewer severe injuries. These models have been incorporated into key national guidance documents, including AASHTO’s Highway Safety Manual and TRB’s Highway Capacity Manual. A related NCHRP research project developed NCHRP Report 672: Roundabouts: An Informational Guide, Second Edition, a definitive resource to help agencies draw from the most successful design, construction, and management techniques nationwide.

“...our ultimate success will be in creating a transportation culture of innovation that’s open to new ideas and new ways of doing things. ... We want things that seem new today to be common practice tomorrow, and for that process to keep renewing itself as new ideas and new technologies are developed.”

Victor Mendez
Administrator, FHWA
PLANNING SMARTER, MANAGING BETTER

POLICY RESEARCH ADDRESSES QUALITY OF LIFE AND ELDERLY MOBILITY

Policy research is an integral component of a robust research program; it complements engineering-based investigations and helps DOTs make informed decisions affecting travelers and the transportation system. For example, groundbreaking Minnesota consumer research revealed that citizens regard transportation as a central quality of life factor and associate it with education, the environment, employment, and housing. Minnesota DOT is using the research findings to refine its transportation performance measures while also informing long-term corridor planning with state and local partners. Nearby, Michigan DOT undertook a comprehensive study to develop strategies that will help keep older Michigan travelers safe and mobile. The research supports Michigan policymaking efforts by outlining the potential impacts, costs, and implementation considerations for a number of strategies, ranging from senior driver-friendly engineering solutions to mobility alternatives for elderly travelers.

SOUTH CAROLINA LEGAL RESEARCH PROTECTS THE STATE AND TRAVELERS ALIKE

Traffic injury tort claims and lawsuits are costly for all state highway agencies. In South Carolina, where claim and lawsuit payouts, indirect fees, and labor costs had grown to more than $4 million a year, the state conducted research to address this complex subject that involves both safety and legal issues. Investigators recommended developing a statewide database among other strategies to support a more effective, efficient, and consistent claims review and investigation process. Reducing claims and lawsuits will allow South Carolina DOT to shift resources to high-priority delivery and maintenance of the state’s transportation system. Moreover, the information system’s enhancements will help the agency better analyze collision risk factors and identify engineering countermeasures to improve safety and protect all South Carolina travelers.

DATA-DRIVEN POLICY TOOLS FOR A CHANGING ECONOMY

Economic and societal shifts mean new challenges and tough decisions for DOTs. Research-based analysis provides state lawmakers and agency executives with information to make well-informed decisions. For example, in Kansas, modern agribusiness and changing rural populations led to an examination of the state’s rural road system. Research by Kansas DOT helped to determine which rural counties can save money by closing certain low-volume roads. The savings can be used to improve other county highways currently strained by heavy agricultural vehicles. In Georgia, uncertainties about the state’s future fuel tax revenues—impacted by oil production, transit use, and the hybrid-electric vehicle market—led Georgia DOT to develop a revenue estimation toolbox. It will enable planners and policymakers to assess how different scenarios will impact future fuel tax revenues and then formulate strategies to adapt.

“State DOTs play an integral role in national transportation research by developing research ideas through AASHTO committees, participating on NCHRP research project panels, and, of course, implementing results back home.”

Sandra Larson
Director, Iowa DOT Research and Technology Bureau
Chair, AASHTO Research Advisory Committee
A GREENER TRANSPORTATION SYSTEM

STATES PUSH PAVEMENT RECYCLING ENVELOPE
Extensive recycling of both asphalt and concrete pavement puts transportation among the greenest industries, and DOTs continue to extend the limits of their current practices for reusing highway materials. For example, projects across the United States are incorporating higher allowable percentages of reclaimed asphalt pavement—or RAP—in new highway pavements. New Jersey DOT research helped establish the feasibility of pavements composed of 35 percent RAP (where 15 percent is a common maximum).

Pennsylvania and Mississippi DOTs each conducted research to evaluate levels of RAP as high as 50 percent in warm-mix asphalt—a green technology in its own right—and results are promising. These environmentally friendly practices come with significant financial benefits, too: New Jersey estimates that for a 25,000-ton pavement project, using 35 percent RAP can result in a savings of $330,000.

ADVANCED MONITORING HELPSDOTSPROTECT WILDLIFE
Where nature and the transportation system intersect, DOTs across the nation investigate and implement new methods to understand wildlife behavior and protect animals. For example, Maryland and Maine DOTs each undertook remote video monitoring programs to document how and where wildlife uses culverts to avoid traffic. The states are using the data to formulate plans for sizing, and placing culverts and fencing to better accommodate the most common species and mitigate collisions at roadkill hot spots. North Carolina drew on direct monitoring techniques as a planning step in a major highway widening project, which led to highly targeted, cost-effective crossing structures for native species like the black bear and red wolf. Utah, which has been building wildlife fencing and crossings over and under roads for decades, conducted a three-year study that showed more than 23,000 mule deer passages at various crossings instead of on the highway. Features of the most effective crossings are being considered for future crossings to preserve more wildlife and further improve safety for Utah motorists.

FLORIDA PROTECTS ITS WATERS BY CUTTING BACK ON CHEMICALS
To help improve water quality in Florida, the Florida Department of Environmental Protection mandated that the state DOT reduce nutrient loading in a major river watershed. (The alternative was for the DOT to buy nutrient loading credits on the order of $1 million per year.) A Florida DOT research study on nutrient leaching and runoff established that simply ceasing maintenance roadside turf fertilization would meet the new standards. However, ensuring healthy roadside vegetation is important for erosion control. Researchers took the next step and found that naturally occurring nitrogen in the region’s soils and rainfall is sufficient to maintain healthy roadside turf. It was a win for all involved. Florida DOT avoided purchasing offsets and is saving another $150,000 annually in fertilizer and application costs. More importantly, the practice is preventing more than nine tons of nutrient loading into the river every year.

ACKNOWLEDGMENT OF SPONSORSHIP Work was sponsored by the American Association of State Highway and Transportation Officials, in cooperation with the Federal Highway Administration, and was conducted in the National Cooperative Highway Research Program, which is administered by the Transportation Research Board of the National Academies.

Automated flagger image courtesy of Synergy Technology.

DISCLAIMER: The opinions and conclusions expressed or implied in reports are those of the research agencies. They are not necessarily those of the Transportation Research Board, the National Research Council, or the program sponsors.