A GREENER TRANSPORTATION SYSTEM, continued

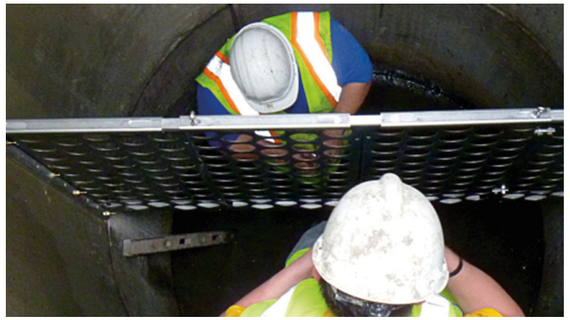
INDIANA DOT FINDS SAVINGS WITH INCREASED USE OF LOCAL MATERIALS

Using locally available aggregates reduces highway construction costs and environmental impacts since materials are not hauled for long distances. Indiana DOT uses locally available aggregates in deeper courses of asphalt pavements, but has avoided using them in surface mixes because of concerns about pavement friction. However, a recent study sponsored by Indiana DOT found that it is possible to use some local aggregates in mixes—at about 20 to 30 percent—without a significant decrease in friction. Researchers also developed a low-cost laboratory screening test to identify which candidate local aggregates warrant the expense of additional field trials, leading to further cost savings.

SOUTH DAKOTA TO SAVE MILLIONS THROUGH ENERGY EFFICIENCY RECOMMENDATIONS

State governments are increasingly adopting conservation strategies to reduce both the costs and environmental impacts of operations. South Dakota DOT recently developed a comprehensive energy management program and plan that will lead to significant energy savings for its facilities. Researchers evaluated SDDOT's existing energy use and policies, identifying operational and organizational improvements for increasing energy efficiency. The department's first focus will be to make facility improvements that will lead to several million dollars of energy savings over the next 10 years. SDDOT's example, along with national guidance like the recent *NCHRP Report 751: Renewable Energy Guide for Highway Maintenance Facilities*, will provide direction for other agencies in South Dakota and across the nation.

MINNESOTA DEVELOPS COST-SAVING DEVICE TO REMOVE STORMWATER SEDIMENTS



To minimize the effects of stormwater runoff, which can carry pollutants from paved surfaces into waterways, agencies often use pollution control devices. Since these proprietary devices can be expensive, Minnesota DOT examined whether standard sumps that are already a common feature of stormwater infrastructure could be used to remove pollution-carrying sediments from runoff. Researchers at the University of Minnesota's St. Anthony Falls Laboratory developed the SAFL Baffle to improve sump performance, particularly at high rates of stormwater flow when sediments tend to wash out. Research demonstrated that the SAFL Baffle, now used widely in Minnesota, virtually eliminates this washout and improves sediment capture by up to 15 percent. On average, sumps equipped with this device are removing sediments at one-fourth the cost of previous devices.

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**.

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.

Project links are available in the online version of this document at research.transportation.org:

PAVEMENT CONSTRUCTION TECHNIQUES
- Arkansas' research statement
- Georgia's research statement

BRIDGE INNOVATIONS
- Kentucky's research report
- New Jersey's research brief

PENNSYLVANIA'S FULL DEPTH RECLAMATION
Research report

HIGHWAY SAFETY MANUAL
- NCHRP's research brief
- Illinois' research report

PEDESTRIAN AND BICYCLE RESEARCH
- Michigan's research summary
- District of Columbia's research report website
- Florida's research report
- Utah's research report

DRIVER BEHAVIOR
- Wyoming's research report
- Wisconsin's project page

FHWA RESPONDER TRAINING
Program Web page

LOUISIANA'S HEAVY TRUCK OPERATIONS
Research on highways and bridges

GEORGIA'S DESIGN-BUILD GUIDE
Design-Build website

NORTH CAROLINA'S REMOTE VEGETATION SENSING
Research report

INDIANA'S LOCAL PAVING MATERIALS
Research report

SOUTH DAKOTA'S ENERGY MANAGEMENT PROGRAM
Research work plan

MINNESOTA'S RUNOFF BAFFLE
Research summary

See AASHTO's research website, research.transportation.org, for additional high-value state DOT research projects.

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RESEARCH
Makes the Difference 2013

INNOVATION ADVANCES TRANSPORTATION

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 the states' 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.

> "Innovations in transportation and the application of research findings are keys to improving the nation's mobility, boosting the economy, and enhancing our quality of life."
>
> **Frederick "Bud" Wright**
> Executive Director, AASHTO

BUILDING LONGER-LASTING ROADS AND BRIDGES

NOVEL PAVEMENT CONSTRUCTION TECHNIQUES PROMISE SAVINGS

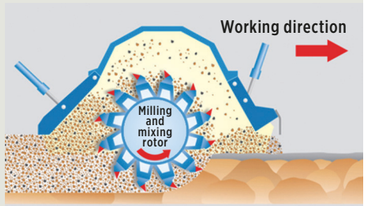
A recent project by the Arkansas State Highway and Transportation Department is piloting the rehabilitation of pavement using roller-compacted concrete pavement, or RCCP—a low-cement mixture that can be placed without forms, dowels, joints, or finishing, and compacted with rollers. RCCP can withstand heavy traffic loads and be opened to traffic within 48 hours. Results from two one-mile test sections showed that RCCP can be used for rapid, low-cost rehabilitation with savings of up to $2 million per mile. Elsewhere, Georgia DOT research is optimizing the cost and long-term performance of inverted base pavement systems, an innovative pavement design in which increased stiffness of supporting layers allows a thinner surface layer, reducing construction costs. Test section performance has been positive, and allowing this type of pavement as an alternative design in the future can increase competition and further drive down costs.

INNOVATIVE MATERIALS AND ANALYSIS METHODS PERMIT HEAVIER LOADS ON BRIDGES

Finding ways to increase loads that can be safely accommodated by bridges can lead to significant economic benefits. The Kentucky Transportation Cabinet recently retrofitted a 79-foot bridge deck in just two hours using high-strength aluminum panels overlaid with asphalt in place of the deteriorated concrete deck. The deck's significantly lighter weight allows it to carry heavier trucks, its reduced construction time minimized traffic delays, and the corrosion-resistant aluminum will increase longevity. For rail bridges, New Jersey DOT research examined the impacts of a recent increase in freight railcar weight limits on various passenger lines within the state, using finite element models and live-load testing to confirm the bridges could handle the additional weight. An economic analysis of one drawbridge found that raising load limits could save $7.49 million over 25 years.

PENNDOT STANDARDIZES FULL DEPTH PAVEMENT RECLAMATION

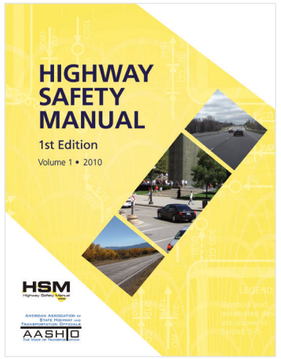
DOTs across the United States are implementing faster, lower cost, and more sustainable methods for rehabilitating deteriorated pavements. Pennsylvania is currently finalizing specifications and training to standardize one such method, full depth reclamation, for use by all contractors working for the state. The method involves pulverizing the existing pavement; blending it with the underlying base and a stabilizing agent (portland cement, asphalt emulsion, or lime) to create a base; and placing a new asphalt or concrete layer. Because the method recycles existing materials, it is both an economical and environmentally friendly way to add structure and stiffness to roadway foundations that were not originally designed for their current loads, a common problem in Pennsylvania where heavy drilling equipment is being hauled over secondary roads.



Stabilized construction material mix

SAFER HIGHWAYS AND WORK ZONES

NCHRP AND STATES ADVANCE HIGHWAY SAFETY



NCHRP was the driving force behind AASHTO's *Highway Safety Manual*, which provides states with a modern, science-based approach to safety management, analysis, planning, and delivery. NCHRP research developed the HSM's core methodologies, supported its production, and assisted in building implementation and training tools. As states take steps to put the manual's methods into practice, NCHRP is providing support to accelerate implementation. To jump-start the NCHRP HSM Lead State initiative, Illinois DOT led a peer exchange with representatives from other lead states and FHWA to share deployments of different HSM techniques as well as approaches to overcome implementation barriers. This kind of active commitment to putting the manual to work will help fulfill the common mission among all state DOTs to institutionalize highway safety and wisely spend safety dollars for maximum user benefit.

STATES IMPROVE BICYCLE AND PEDESTRIAN SAFETY TREATMENTS

State DOTs across the nation are engaged in research and implementation to improve bicycle and pedestrian safety:

- Michigan DOT developed a best practices design guide detailing 40 different safety improvements for walking and bicycling and their impacts on crash rates and mobility. MDOT has already implemented buffered and painted bike lanes as a result of this work.
- A District of Columbia DOT before-and-after study on new bicycle facilities—including bicycle boxes, dedicated lanes, and bicycle signals—provided insights on cyclist and driver behavior and is helping DDOT tweak existing facilities and improve designs of new ones.
- Florida DOT's research on older transportation users—both as drivers and pedestrians—guided Florida in implementing only the most effective treatments, such as fluorescent sheeting to increase urban sign visibility.
- Utah DOT analyzed high- and low-risk intersections for cyclists and pedestrians and found that incorporating longer signal lengths, providing dedicated right turn lanes, and adding street trees at intersections can significantly reduce nonmotorized accidents.

> **"The game has changed when it comes to transportation funding and oversight. Research can help us deliver infrastructure more efficiently and effectively than ever before."**
>
> **Michael Lewis**
> Director, Rhode Island DOT, and President, AASHTO

IMPACTING DRIVERS' SPEED IN WYOMING, ROUTE SELECTION IN WISCONSIN

Research can help DOTs influence driver behavior and make roads safer. For instance, Wyoming DOT explored variable speed limit signs to reduce traffic speeds and improve safety in dangerous driving conditions. The results of test installations of VSL signs along 143 miles of Interstate highway were impressive: an estimated 50 fewer crashes per year and observed adherence to reduced speed limits. The study also led to legislation allowing enforcement of VSLs and expanded implementation on new routes. In another example, Wisconsin DOT research examined why drivers often choose not to use alternative routes—particularly during unplanned or emergency road closures. The study produced a toolbox of communication tools and strategies to meet drivers' informational and decision-making needs. A multistage program will promote 511 services, consider more intuitive alternate route signage, and expand the use of situation-responsive tools like highway advisory radio and dynamic message signs.

QUICK INCIDENT CLEARING IS A NATIONAL PRIORITY

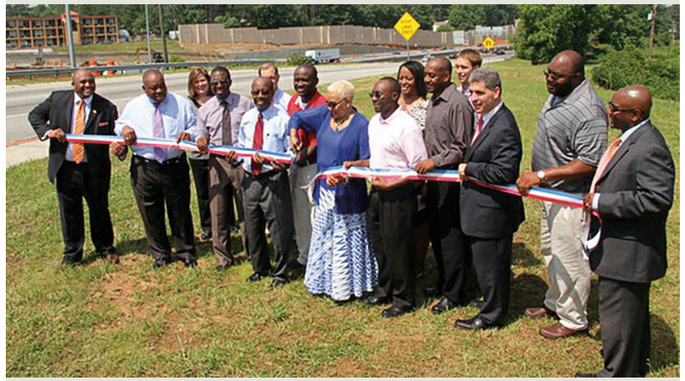
Responders to traffic incidents such as crashes, disabled vehicles, and roadway debris perform an invaluable public service but expose themselves to dangerous secondary collisions. A training program developed by the Second Strategic Highway Research Program and promoted through FHWA's Every Day Counts initiative helps incident responders—police, firefighters, EMS, and towing vehicles—better coordinate their efforts to more efficiently clear traffic incident scenes. This reduces secondary accidents and safeguards responders and motorists alike. Moreover, given that a single minute's time of lane blockage results in an additional four minutes of traffic delay, quicker incident clearing can make a big difference in the country's annual 4.2 billion driver-hours in delays. To date the program has reached 23 states with approximately 13,000 responders trained, and the goal is to reach all 50 states plus the District of Columbia and Puerto Rico by December 2014.

PLANNING SMARTER, MANAGING BETTER

LOUISIANA LEGISLATORS ACT ON HEAVY TRUCK RESEARCH

Sugarcane is an important cash crop in Louisiana, but with overload permits raising legal loads from 80,000 pounds to 100,000 pounds, heavy sugarcane haulers were inflicting excessive road and bridge wear. Researchers found that the average annual damage caused by heavy sugarcane trucks—$2,000 per vehicle to highways and $3,500 to bridges—far exceeded the state's $100 special truck permit. Rather than hiking the permit fee, an alternative approach showed that requiring a minimum of six axles on the sugarcane trucks could effectively mitigate the damage. This solution was successfully enacted into Louisiana state law in 2012. It not only stemmed the costly cycle of damage and repair to roads and bridges, but tax incentives helped cover truck owners' costs to convert or replace noncompliant trailers.

GEORGIA DESIGN-BUILD GUIDANCE BOOSTS LEGISLATIVE LIMITS

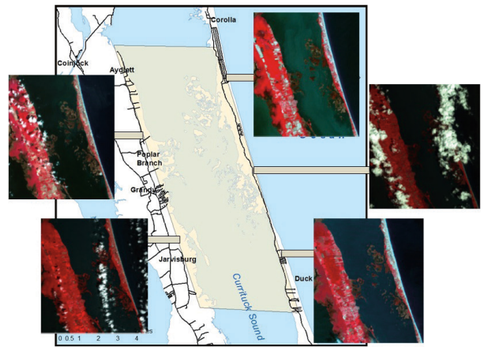


By combining design engineering with construction services into a single contract, design-build contracting can reduce project costs, improve communication, and expedite project delivery. To leverage DB contracting in Georgia, the state DOT sponsored research to develop a selection tool that assesses the benefits and risks of DB selection and provides systematic guidance on when it is the most suitable contracting option. By ensuring transparent and consistent DB implementation, the research results supported state legislative action in 2012 that raised the cap on DB from 30 to 50 percent of Georgia DOT projects and additional legislation in 2013 to allow for Best Value DB contracting.

A GREENER TRANSPORTATION SYSTEM

AQUATIC VEGETATION MEASUREMENT TAKES TO THE SKIES IN NORTH CAROLINA

Along the North Carolina coast, highway projects can impact submerged aquatic vegetation, and North Carolina DOT has state and federal mandates to assess the presence of such vegetation and take appropriate mitigation steps. However, identifying and measuring submerged vegetation over thousands of acres can be technically challenging and expensive with traditional sampling methods. As an alternative, a North Carolina DOT research study used the latest in satellite imaging systems—technology originally intended for land mapping—and applied advanced statistical assessment techniques. Researchers successfully demonstrated that these images detect submerged vegetation and also gauged other features like water depth, temperature, and chemical makeup. The result: a fast and accurate tool for assessing large aquatic areas in a fraction of the time.



> **"State research staff members often find transformative solutions by interacting with their counterparts through NCHRP panels, TRB committees, and national pooled fund studies."**
>
> **Harold "Skip" Paul**
> Director, Louisiana Transportation Research Center, and Chair, AASHTO Research Advisory Committee