

Research Makes the Difference 2011

State DOTs Meet Critical Challenges Through Innovation

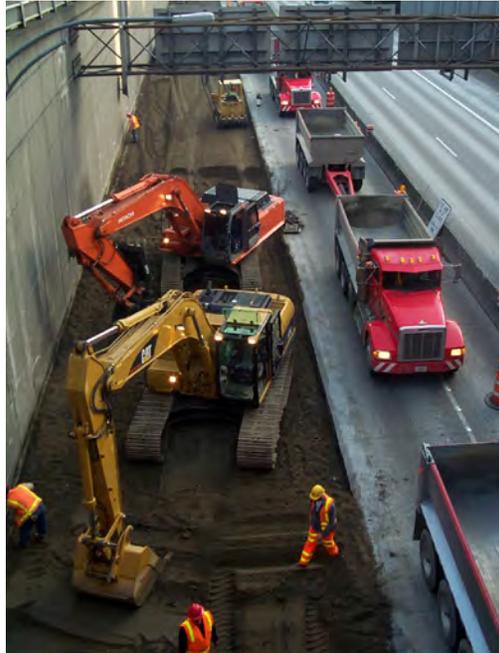
State transportation departments are committed to delivering safer, smarter and more efficient transportation systems. Research and innovation remain the key to this goal. The projects on these pages, funded through the national programs below, are *just a few standouts that exemplify the high return 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 voluntarily 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.

SAFER HIGHWAYS AND WORK ZONES



MAKING INTERSTATE WORK ZONES SAFER IN INDIANA

Urban Interstate construction projects carry heightened safety concerns given the typical traffic speeds and volumes. Indiana DOT used the reconstruction of a 6-mile stretch of I-70 in central Indianapolis to test the effectiveness of new work zone safety countermeasures. The \$132,000 study employed advanced safety models to measure the effectiveness of targeted traffic management techniques. Rerouting the heaviest vehicles to other Interstates proved to be a highly successful management strategy, as did the combination of added police enforcement and reduced speeds in work zones. Using these approaches, the agency estimated it reduced the number of crashes by about 100, a decrease of 40 percent. The overall benefit to the agency and the public was approximately \$2 million.

IOWA ENHANCES NIGHTTIME SAFETY WITH NEW PAVEMENT MARKING STRATEGIES

While many research studies have tested the visibility and reflectivity (or retroreflectivity) of pavement markings, Iowa DOT took the next step of correlating crash data with levels of reflectivity for various pavement marking types. The findings of this research provided guidance on pavement marking decisions, not only about when and where

to reapply treatments, but also by identifying locations that might be made safer with more durable treatments beyond the standard pavement marking application. The findings are helping Iowa optimize expenditures on its pavement marking program to maximize safety.



“Collaboration among states is invaluable. AASHTO helps states jointly define and address research needs, and just as importantly, put the findings to work in improving the design, construction, and safe operation of our transportation infrastructure.”

Kirk Steudle
Director, Michigan DOT
Incoming AASHTO President

UNIQUE FENCING SEPARATES VEHICLES FROM DEER IN GEORGIA

Georgia DOT knew there had to be a better way to separate the deer population from motorists, making the highways safer and protecting wildlife at the same time. After first assessing how the animals responded to physical barriers, investigators evaluated the effectiveness of two fencing designs: a standard 8-foot fence and a 5½-foot fence that includes an angled outrigger along its top to act as a one-way animal barrier. The innovative outrigger design showed great promise in both cost savings and enhanced safety. In field tests, the outrigger fence reduced deer movement along highways by 90 percent, and it was \$3,200 cheaper per mile than the standard 8-foot fence—a savings of 20 percent. The relative affordability of this unique design may create opportunities for the installation of added fencing mileage and the retrofitting of existing fences to help reduce deer-vehicle collisions.



“The transportation system plays an important role in the economic vitality of our country, and innovation—often based on research—grows more and more important as our financial resources become constrained.”

Robert Skinner
Executive Director, TRB

BUILDING LONGER-LASTING ROADS AND BRIDGES



SMARTER BRIDGE REPAIR WITHOUT COMPROMISING SAFETY

Safety will always be the first concern for bridges, which makes new techniques for assessing and addressing deterioration so important. With this in mind, the Kentucky Transportation Cabinet saw the potential of carbon fiber-reinforced polymer fabric to repair bridges that otherwise would require replacement or costlier repair techniques. The retrofit of a three-span prestressed bridge has been studied for a decade and demonstrated outstanding performance, leading Kentucky

to employ this method on a dozen additional bridges. Using this technique, the state can save \$500,000 per bridge, and motorists enjoy spans that remain open during repairs.

Determining *when* to repair bridges is just as important as *how*, as Maine DOT demonstrated with its advanced SlabRate software. Using finite element analysis and calculations from AASHTO’s 2009 Manual for Bridge Evaluation, Maine assessed the load-carrying capacities of 20 concrete slab bridges. Among these, over a dozen that would not have had acceptable operating ratings using traditional assessment methods were shown to be sound when evaluated using these advanced techniques. Given the million-plus dollars required for just one bridge replacement, the \$200,000 research cost is already paying off and helping position Maine to better direct its repair efforts.

STATES IMPROVE PAVEMENTS AT EVERY LEVEL

From riding surfaces down to subsoils, state DOTs are leading research efforts to improve every aspect of pavements. For example, Maryland State Highway Administration developed an advanced method to evaluate asphalt pavements’ surface friction—a major factor in performance and safety. The new technique to test susceptibility of aggregates to unwanted polishing takes a fraction of the time of standard tests and provides vital data for quality control.

Quality must run all the way to the bottom of a pavement. Wisconsin, Iowa, and Minnesota DOTs, among others, have attested to this by putting the emerging technology of intelligent compaction through its paces for both asphalt lifts and pavement subgrade layers. Compaction measurements collected in real time by specially equipped rolling drums allow workers to respond to compaction deficiencies. It’s a promising technology to help ensure long-lasting, high-performance roads.

And in Alaska, where building on loose and sandy soils presents a major challenge, the state’s Department of Transportation and Public Facilities is testing the use of inexpensive geofibers and synthetic fluids



to strengthen underlying base layers. Results so far are very encouraging, with significant and lasting increases to the bearing capacity of subsoils.

A GREENER TRANSPORTATION SYSTEM



CONNECTICUT TRANSIT GOES GREEN WITH HYBRID BUSES

Connecticut DOT seized the opportunity afforded by new technologies to make its transit system more environmentally friendly without sacrificing performance or cost. Connecticut Transit deployed hybrid diesel-electric buses over several years, studying their performance side-by-side against standard clean diesel buses. After extensive testing and system optimization, the hybrid proved

its value: Connecticut reports that fuel economy for its hybrid buses now exceeds that of its diesel-only buses by 15 percent or more, and life-cycle costs are actually lower for the hybrid vehicles.

In a companion research effort, the agency tested a new diesel exhaust filter targeting particulates of 10 to 130 nanometers—the range of greatest concern for public health. Buses retrofitted with the filter showed a remarkable drop in emissions of these particulates: fully 99 percent. Connecticut led the way for other transit systems to invest with confidence in hybrid buses and to retrofit existing buses with particulate filters.

THE CLEAN WATER MESSAGE IN NEW HAMPSHIRE

New Hampshire DOT is committed to protecting water quality, and the agency knows it can't do it alone. To educate communities, students, contractors, and even its own employees about this critical issue, the agency's Stormwater Outreach Team developed a series of interactive training tools. Various hands-on water table models illustrate point and nonpoint source pollution and show how stormwater travels through soil and traditional drainageways. Together with presentations, videos, and trained staff to answer questions, the mobile display helps New Hampshire promote environmental stewardship across the state. The outreach tool serves a second purpose as well, helping NHDOT comply with regulations for EPA's National Pollutant Discharge Elimination System.



“Dollars spent on transportation improvements yield very high economic returns. Research helps us make even smarter investments to meet the highest-priority needs across all modes of transportation.”

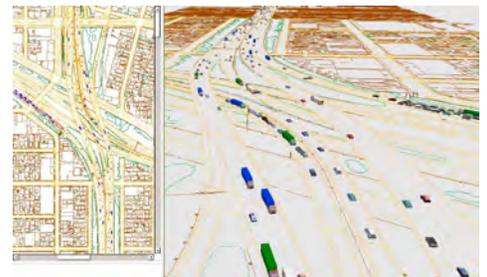
Neil Pedersen

Former Administrator, Maryland SHA
Chair, TRB Executive Committee

PLANNING SMARTER, MANAGING BETTER

STATES ADDRESS CAPACITY THROUGH NCHRP

States must find the right strategies to expand highway capacity while balancing costs, land use, level of service, environmental impacts, and other factors. The Transportation Research Board has provided national guidance on capacity



since the first Highway Capacity Manual in 1950, and NCHRP has conducted ongoing research for updates to the manual in the decades that followed. The latest edition of the Highway Capacity Manual, published in 2010, includes guidance on new challenges and technologies to address them—roundabouts, freeway weaving, shared-use paths, and active traffic management, to name a few—and puts the best decision-making tools in the hands of all transportation agencies. State, county, and municipal government officials, as well as contractors and industry users, rely on this authoritative document to define performance measures and predict quality of service for transportation facilities.

EASING CONGESTION WITH ADAPTIVE TRAFFIC SIGNAL TIMING

The annual cost of traffic congestion in the United States is a staggering \$87 billion in wasted fuel and lost productivity. Through its Every Day Counts initiative, FHWA is helping states implement an intelligent transportation technology that can make a real dent in that number. Adaptive signal controls adjust the timing of stoplights to accommodate changing traffic patterns and ease congestion, providing optimal and equitable green-light time for all motorists.

While the timing of traditional manually programmed traffic lights may become out of date as traffic patterns change over time, this adaptive technology gathers data on traffic in real time and automatically responds to dynamic conditions. The benefits are numerous: fuel savings, emissions reductions, improved mobility, and enhanced customer satisfaction. From coast to coast, agencies are adopting this technology and seeing motorists' travel times improve by as much as 50 percent.



WASHINGTON STATE SAVES BY COLLABORATING ON MAIN STREET DESIGN

On state highways that also serve as main streets in municipalities, DOT projects typically undergo costly scope and schedule revisions to meet community demands. Through a \$47,000 research project, Washington State DOT developed and piloted a program to engage community members early in the design process. By actively building consensus and addressing a range of both agency and community concerns—traffic flow, livability, safety, tourism—WSDOT is delivering main street highway projects more quickly and with fewer changes, with an average estimated savings of over \$9 million per project.



POOLED FUND HELPS STATES OPTIMIZE WINTER MAINTENANCE

The Maintenance Decision Support System pooled fund study is a collaborative effort of 16 states across the nation. Led by South Dakota DOT, the program developed a winter maintenance tool that weighs such factors as road conditions, weather, and feasible treatment options. By analyzing alternatives and modeling predicted performance, the system can recommend the most appropriate maintenance treatments given an individual agency's available resources and service goals.

Together, the states in the pooled fund study have conducted field deployment trials on nearly 20,000 miles of in-service highways, and they have enjoyed savings up to 25 percent; in the most dramatic example, one state saved \$11 million on a \$40 million program.



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:

Indiana's Interstate work zones
Research summary

Iowa's pavement marking reflectivity research
Research report

Georgia's deer fences
Research report

Kentucky's carbon fiber-reinforced polymer bridge retrofit
Research report

Maine's SlabRate bridge evaluation software
Program summary page

Maryland's aggregate friction study
Research report

Intelligent compaction
Wisconsin's **research report**
Iowa's **program overview**
Minnesota's **program page**

Alaska's soil stabilization with synthetic fibers and fluids
Summary article

Connecticut's hybrid diesel-electric buses
Research report

New Hampshire's stormwater outreach initiative
Project page

NCHRP's Highway Capacity Manual
Research brief

FHWA's adaptive traffic signal control initiative
Program page

Washington's community design for main street highways
Research report

Maintenance Decision Support System pooled fund study
Program page

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