Virginia Transportation Research Council

2007 Annual Report

VTRC
Virginia Transportation
Research Council

A partnership of the
Virginia Department of Transportation
and the University of Virginia since 1948

www.vtrc.net

OUR STORY

Results. That's what the Virginia Transportation Research Council produces almost daily for the Virginia Department of Transportation and the Commonwealth. As the research arm of VDOT since 1948, we have provided sound results and innovations through applied research in numerous program areas including pavements, structures, materials, safety, system operations, and the environment.

The Research Council's primary customer is VDOT. Our location at and partnership agreement with the University of Virginia enhances the quality of our research and provides educational and financial support to faculty and students. We also tap the resources of Virginia Tech, George Mason, and Old Dominion, among other Virginia universities, to expand the diversity and quality of our research program.

This report highlights the research results that we and our partners produced for VDOT and the state during 2007 as we strive to improve every aspect of Virginia's roads for all who drive – and cycle and walk – on them. Our research program in 2007 yielded 51 published research reports, and we have more than 140 active projects under way.

In addition to the project summaries that follow, let me also call your attention to these special accomplishments from this past year:

- With the Research Council's leadership, the Virginia Tech Transportation Institute and U.Va.'s Center for Transportation Studies have agreed in principle to launch the Virginia Center for Transportation Safety Research and Policy Studies.

- The Virginia Cooperative Center for Bridge Engineering, a partnership between VTRC and Virginia Tech, was awarded a prestigious National Cooperative Highway Research Program (NCHRP) contract for "High-Performance/High-Strength Lightweight Concrete for Bridge Girders and Decks." This three-year, $750,000 project will develop changes to the American Association of State Highway and Transportation Officials (AASHTO) load and resistance factor design specifications (LRFD), which will lead to higher-strength, lighter-weight, and better-performing bridges.

- The Research Council collaborated with VDOT's Structure and Bridge Division to obtain a $200,000 grant from the Federal Highway Administration's Innovative Bridge Research and Deployment program. This project sought a means for using self-consolidating, high-performance concrete (SCC) to repair bridge caps and pier column supports. SCC improves consolidation in and around reinforcing steel and is more cost effective than traditional repair methods.

One of VDOT's corporate tenets states that the Research Council will provide a high return on the agency's investment in our work. I am pleased to report that in 2007, our research program resulted in the implementation of recommendations that conservatively will return $125 million to VDOT over a five-year period.

We could not have achieved the successes highlighted here without the talented and dedicated leadership team, scientists, students, faculty, and others who comprise the Virginia Transportation Research Council. I thank and congratulate them here for the great work they do – work that I am convinced touches the lives of all Virginians every single day.

And as we look forward in 2008 to celebrating our 60th year of bringing innovation to transportation, it is our goal to continue to put VDOT at the forefront of advances that are the product of a robust, forward-thinking program of research. In concert with our university, industry and private-sector partners, VTRC will see to it that our goal becomes a reality.

Michael A. Perfater
Acting Director of Research Operations
Virginia Transportation Research Council

CONTENTS

"Research is the pathway to the future. You also are responsible for understanding the past so we do not repeat it. You have the objectivity and the skills to help VDOT set direction and be more efficient and effective in delivering its programs."

"For a CEO, the Research Council is a fantastic resource."

David S. Ekern, P.E.
Commissioner, Virginia Department of Transportation

BRIDGE SERVICE LIFE

The Interstate 35W bridge collapse in Minneapolis in August 2007 directed urgent attention to America's aging infrastructure, particularly the integrity of its nearly 600,000 bridges. Virginia has more than 20,000 bridges and culverts that VDOT maintains.

The Research Council manages a rigorous array of projects aimed at extending the service life of these bridges. Its work also keeps VDOT's research program in the forefront nationally as its scientists study innovative materials and systems for future implementation and secure more grants to spur these advances.

To help the Federal Highway Administration (FWHA) learn more about the cause of the Minnesota disaster, VTRC conducted service-load tests during 2007 on a similar out-of-service deck-truss bridge in southwest Virginia. Plans are under way to conduct further load-failure tests in 2008 that will allow the old structure's critical components to fracture without damaging the adjacent new bridge.

When an inspection found that a post-tensioned tendon under the deck of the Varina-Enon Bridge had failed, the Research Council helped VDOT evaluate the problem and recommended further inspections and repairs to this and other tendons. The original grout used to surround the failed tendon and protect its strands had bled, segregated and leaked, leaving a corrosion-inducing void.

VDOT had installed high-performance grout, a material that VTRC helped develop in 2000, to fill the void when it was first discovered in 2003, but the strands further corroded and failed along the top of the original grout. This cable-stayed bridge on Interstate 295 over the James River was completed in 1990, before the high-performance grout was available, before grout certification was required and before these types of tendons were sealed to ward off corrosion.

With the installation of corrosion-resistant steel reinforcement in a bridge over the Occoquan River in August 2007, VDOT began accepting its use in new bridges in place of epoxy-coated rebar. This ground-breaking change in specification was based on nearly 15 years of Research Council studies, which recommended corrosion-resistant metallic reinforcing bars as the most cost-effective reinforcement for bridges.

Our research showed that epoxy-coated rebar naturally degrades in concrete's highly alkaline moist environment. As a result, its service life is estimated to be only about 35 years. That is less than half the 100-year service life the FHWA now requires for corrosion-resistant reinforcement in the nation's bridges.

VTRC also investigated various accelerated bridge-construction practices and, partnering with Virginia Tech, helped create software that can determine when to prepare for the first repairs on a bridge deck, install the first overlays and conduct other maintenance. These efforts will save money and reduce driving delays and accidents during such repairs.

In other structures work, the Research Council:

- Recommended improved practices for using cathodic protection systems to extend the life of structures

Research Scientist Michael Brown explains the process that VTRC and Virginia Tech used to restore the historic Hawthorne Street Bridge in Covington, Va., using a fiber-reinforced polymer deck that helped increase the structure's load rating nearly threefold.

Cathodic protection systems, which employ applied (electrical) current or sacrificial anodes to mitigate chloride-induced corrosion in a bridge deck's structural reinforcement, can be used to help defer or prevent future bridge rehabilitations and reduce intermediate repairs. The chlorides come from exposure to a marine environment or deicing salts.

This project evaluated various cathodic protection systems VDOT had installed on a selection of bridges over the years. The research found the initial cost of an impressed current cathodic protection system differs little from that of a new bridge deck overlay and thus is an alternative to an overlay. When properly maintained, a retrofitted impressed current system could extend the life of a rehabilitated deck an extra 35 years.

- **Developed and evaluated** a fiber-reinforced polymer bridge deck system

The Research Council, in partnership with Virginia Tech's Bridge Center, employed a fiber-reinforced polymer (FRP) composite cellular bridge deck to rehabilitate the Hawthorne Street Bridge, a historic cast-iron thru-truss structure, in Covington, Virginia. VTRC received a $346,000 grant from FHWA's Innovative Bridge Research and Construction program for this project.

The new deck is 75 percent lighter than a comparable one of concrete, which increased the bridge's load rating from 7 tons to 20 tons. Before VDOT installed the new deck, emergency vehicles had to use several circuitous routes to get through town; they now can travel straight through the center of Covington, shaving vital minutes.

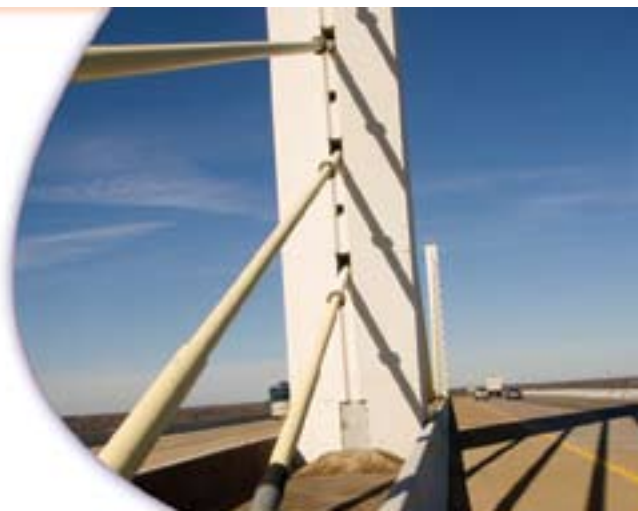
The study recommended that VDOT consider using FRP bridge deck systems on other appropriate bridges, primarily those where the weight savings offset the higher initial material costs. VDOT has installed FRP decks on two small bridges on Tangier Island in the Chesapeake Bay, where transporting and mixing concrete are quite costly. FRP decks also will withstand the corrosive saltwater environment better than traditional concrete.

- **Investigated the "corrosion** propagation characteristics" of new metallic reinforcing bars

VTRC partnered with U.Va. in a study to analyze the corrosion behavior and resistance of various reinforcing steels used in bridges. Scientists performed accelerated electrochemical laboratory tests intentionally designed to offer side-by-side comparisons of different metals.

The study found that corrosion-resistant bars perform better than plain carbon-steel bars. Although performance typically improves with the cost of the metal depending on the additives, using corrosion-resistant reinforcement in bridge decks is more cost effective than rehabilitating the decks or installing new overlays.

The research also indicated that pickling the corrosion-resistant bars could greatly improve their performance. Pickling chemically removes surface scale and other contaminants, such as dirt, from the iron and steel by immersion in an acid solution; it also forms a stable and protective oxide layer on the surface.



The Research Council assisted VDOT in determining what repairs were needed to repair a post-tensioned tendon under the deck of the Varina-Enon Bridge on Interstate 295 over the James River.

MAINTENANCE, DESIGN AND PROGRAM DELIVERY

The Research Council's examinations of stronger, more durable materials and pavements and related processes are nationally recognized. VDOT, the federal government, NCHRP and other states regularly seek VTRC's assistance in resolving issues to improve the service life of the surfaces on our nation's roads.

In 2007, the Research Council and VDOT developed a procedure to help predict the performance of a given pavement and thus select the most cost-effective hot-mix asphalt (HMA) option for a given road project. In one example, a life-cycle cost analysis found that using stone-matrix asphalt on interstate highways, instead of dense-graded mixtures, could save VDOT more than $12,000 per lane-mile.

Applied to Virginia's entire interstate system, a stone-matrix-only resurfacing program would cost roughly $29 million less annually, in 2007 dollars, than the next best hot-mix alternative.

The Research Council also developed and tested a draft special provision for materials and construction, as part of Virginia's larger efforts to produce an end-result specification for acceptance and payment of hot-mix asphalt. More effective end-result specifications will allow inspection staff to rededicate their attention to key pavement production and placement processes – such as joint tacking and surface preparation – that cannot be measured upon delivery to the owner/agency.

The project included draft special provisions for HMA materials and construction and applied "shadow" treatments of these provisions to a subset of Virginia's annual maintenance resurfacing projects. Although these specific production and placement activities were not subject to provision's requirements, the researchers designed the sampling and testing to represent what would have been required had the special provisions been in effect.

The study further determined the likely acceptance outcome for each test project and explored future modifications to specification limits and pay-adjustment criteria. The next step will include developing and simulating statistical quality-assurance special provisions for asphalt concrete material and pavement.

One conservative estimate suggested that VDOT could save more than $2 million per year through an end-result specification for acceptance of HMA pavements.

The service life of asphalt depends on the durability of its aggregate. The Research Council evaluated the Micro-Deval test, developed in France and modified in Canada, to weigh its suitability in assessing the durability of coarse and fine aggregates that come from Virginia sources. In the Micro-Deval test, a rotating steel drum tumbles the aggregate with water and steel balls to show how the materials degrade, indicating their durability when exposed to the elements.

Our analysis found the Micro-Deval test had a high potential in evaluating aggregate durability with greater precision and accuracy than the conventional magnesium sulfate and Los Angeles abrasion tests. This method also distinguished between good- and poor-performing aggregates at least 70 percent of the time. As a result, our researcher recommended that VDOT use the Micro-Deval test as a quality-control tool in assessing Virginia aggregates to supplement its current aggregate quality tests.

Left: *Self-consolidating concrete is one of several innovative materials VTRC scientists study.*

Right: *Principal Research Scientist Celik Ozyildirim displays a temperature and moisture sensor that will collect data from the concrete same at his right.*

Warm-mix asphalt (WMA) is a clean and economical alternative to hot-mix asphalt. The Research Council oversaw several WMA installations in a 2007 study and is conducting further tests in the laboratory to determine its practicality for Virginia's diverse geographic regions.

Introduced from Europe in 2002, WMA is still in the exploratory stage in the United States. Early tests have shown that warm mixes may provide many benefits, from reduced greenhouse gases and lower fuel costs to better working conditions for field crews, more durable pavements and longer paving seasons.

Asphalt mixes normally are produced in the range of 280 to 325 degrees Fahrenheit. WMA can be produced about 50 to 75 degrees cooler at the plant. This results in lower energy consumption and plant emissions, saving producers money.

This also means that WMA can be applied when the weather is cooler, which extends the paving season and allows work to continue when traffic volumes are lower. VTRC's recent study found that a contractor hauling 320 tons of WMA to one of the test sites reported a 30-degree drop in the mix's temperature with "no difference in workability."

VTRC also:

- Produced a new application to improve the use of VDOT's existing Internet-based geotechnical database

This project, which VTRC conducted in partnership with Old Dominion University, produced a new module that enhances the interconnectivity among existing applications and data sources on VDOT's geotechnical database. The upgrade provides VDOT geologists and engineers with an automated upload of geotechnical information at the project level, resulting in more streamlined management and use of the data.

The report estimated that the system can save VDOT about $272,000 per year based on the projected annual workload of 136 bridges. Other transportation-related data – pavements, drainage structures, traffic-control devices, safety hardware and environmental site assessments – can also be easily added to this database.

- Evaluated high-performance, continuously reinforced concrete pavements on two major Virginia highways

This study assessed the durability and strength of continuously reinforced concrete pavements that VDOT constructed on sections of Route 288 near Richmond and the U.S. 29 bypass around Lynchburg. It found that satisfactory strengths can be obtained after 28 days using high-performance concretes with pozzolans, materials added to a concrete mixture to increase its long-term strength.

The report recommended that VDOT continue to use high-performance continuously reinforced concrete pavements. The enhanced durability of this concrete can provide a 10 percent increase in the service life with minimal maintenance costs, which equates to millions of dollars in savings each year.

Left: *Research Scientist Stacey Diefenderfer places a sample of warm-mix asphalt into a gyratory mold in the VTRC laboratory.*

Right: *Research Council scientists strive to improve the durability and cost-effectiveness of the pavements VDOT uses.*

SYSTEM OPERATIONS

VDOT's system operations program focuses on the safe and efficient movement of traffic on Virginia's roadways. The Research Council's projects in this area actively support this program.

Two recent studies analyzed the benefits and core functions of VDOT's investment in the safety service patrols. These patrols – employed on interstates in Northern Virginia, Fredericksburg, Salem, Winchester and Staunton/Charlottesville – clear obstructions from the roads, move disabled vehicles, help stranded motorists and assist emergency-service providers with traffic control at crash scenes.

One study found that VDOT's safety service patrol (SSP) in Hampton Roads provides a nearly five-to-one benefit compared with what VDOT pays to provide this service. During the one-year study period, VDOT spent $2.35 million on the SSP and recouped an $11.08 million benefit.

The monetary benefit of the Hampton Roads SSP came from reduced delays and fuel consumption (in 2006 dollars). The SSP saved more than 455,000 vehicle hours of delay and more than 687,000 gallons of gasoline, while also reducing vehicle emissions. The study also identified other benefits, such as allowing the Virginia State Police to conduct more law enforcement and reducing the time for emergency-services providers to clear the scene.

The other study developed a formula to assist VDOT when it considers expanding or changing SSP coverage. The tool ranks several variables per segment of road – such as the predicted number of incidents – and then prioritizes the routes, providing a clear indicator of which road segments would benefit the most from SSP deployment.

An investigation of existing truck-lane restrictions found that crashes dropped by 23 percent and overall average speeds increased by about 5.5 mph on two-lane interstate segments with such restrictions in place. Low-volume interstates with three or more lanes in each direction showed a 10 percent drop in crashes, while crashes increased along high-volume sections of interstates with three or more lanes.

Legislation passed in 2007 requires that both trucks and combination vehicles – such as cars pulling trailers – must drive at or above the speed limit to legally use the left passing lane on an interstate. A subsequent project will determine the safety and operational impacts of the law and assess what effect existing restrictions have on interstates with three or more lanes per direction and on high-volume traffic (more than 10,000 vehicles per lane per day).

VTRC evaluated for VDOT and the City of Norfolk the benefits of a continuous-flow intersection (CFI) over a traditional design. A CFI is an

Associate Principal Research Scientist Ben Cottrell analyzes information for a system operations research report.

at-grade, or single level, intersection that moves left-turning traffic out of the main intersection and down the road several hundred feet to make its turn, thus eliminating the left-turn signal phase for the through traffic.

We conducted traffic simulations comparing the operation of a CFI to traditional intersection improvements. Our analysis prompted the City of Norfolk to request a new design for the intersection at Military Highway and Northampton Boulevard that incorporates a CFI.

Two system operations projects illustrate the value to VDOT of the Research Council's university partnerships. These studies produced vital tools in VDOT's use of technology and other services to reduce congestion and increase the efficiency of existing roadways.

One was the first phase of a long-term initiative on vehicle infrastructure integration, or VII, conducted by the University of Virginia's Center for Transportation Studies. VII supports secure two-way communication between vehicles and between the transportation infrastructure and vehicles.

The U.Va. researchers developed a simulation test bed, using part of Northern Virginia's road network, that will allow VDOT to explore further VII applications. They used the test bed in this project to evaluate a traffic-monitoring application of VII data.

The study found significant benefits for VDOT with the high-quality traffic data from the VII application, balanced, however, by its substantial installation costs. It also recommended further research to refine the parameters that will increase the benefits of VII for VDOT in the future. The second phase of this program will study the impacts of VII probe data on operations applications and of VII in general on VDOT's future infrastructure investment decisions.

The other project, conducted by the Virginia Tech Transportation Institute, provided the first-of-its-kind dataset on naturalistic driving behavior at stop signs – i.e., how drivers do or don't respond to stop signs. This data-collection approach reflects real-world behavior, in this case driver responses to road conditions, and lays the groundwork for developing warning algorithms that could help avoid collisions at such locations.

Associate Research Scientist Lance Dougald monitors video screens inside the VTRC Smart Travel Van. The van is equipped to collect on-site, real-time traffic data from any urban or rural area in the state for Research Council projects and for the joint U.Va.-VTRC Smart Travel Lab.

SAFETY

One thousand and twelve – that's how many traffic and pedestrian deaths Virginia recorded in 2007. To stem the growth of this dire statistic, VDOT joined with the state police, Department of Motor Vehicles and other agencies and organizations in a multi-year statewide Highway Safety Challenge to improve traffic safety in the Commonwealth.

The Research Council contributes significantly to innovations in safety practices at VDOT. In 2007, VTRC scientists:

- **Analyzed the impact** of red-light camera enforcement on crashes in Virginia

This study found that photo enforcement reduced red-light running crashes (mostly angle or side impact) by about 42 percent. This is significant, given that angle crashes tend to be more severe than rear-end crashes. The study also found, however, that rear-end crashes increased by about 27 percent.

The combination of these two crash rates produced a 12 percent overall increase in crashes. These results varied significantly by intersection and jurisdiction.

The researchers based their findings on data from more than 3,500 crashes at 28 intersections with cameras and 44 intersections without cameras. The intersections studied were all in Northern Virginia localities.

The report recommended that localities should make their decisions regarding the use of camera enforcement on a case-by-case basis, factoring in signal timing, length of yellow-light phase, sight distance and the history of red-light running and rear-end crashes at the intersection. The 2007 General Assembly passed a law allowing certain localities, at their discretion, to use red-light camera enforcement and requiring VDOT to approve the selected intersections.

- **Developed a procedure** to identify high-risk signalized intersections in Northern Virginia

The application, a new data-integration software, will synchronize with VDOT's existing databases to speed the analysis of these intersections for safety improvements. Traffic engineers previously had no easy way to quickly determine if an intersection had a high crash risk. They now do.

The study found that the time of day significantly affects crash occurrences and the safety effects of left-turn signal phases. The report provided a new formula for identifying these intersections as well as a spreadsheet application and guide for using it. VTRC is working with VDOT to implement the application at many signalized intersections in Northern Virginia.

- **Conducted its annua**l survey of safety-belt and motorcycle-helmet use in Virginia

The study determined that the rate of safety-belt use in 2007 was 79.9 percent – up slightly from the 2006 rate of 78.7 percent, but lower than Virginia's all-time high of 80.4 percent in 2005.

The rate of motorcycle helmet use was 96.1 percent. In the previous 15 surveys, virtually all motorcycle drivers and passengers that were observed did use a helmet.

Associate Research Scientist Young-Jun Kweon developed the application to help VDOT better analyze high-risk intersections in Northern Virginia.

PLANNING AND THE ENVIRONMENT

VDOT depends more and more on the Research Council's planning expertise as the agency becomes a key player in the Commonwealth's transportation and land-development process.

A 2006 state law codified how Virginia conducts and coordinates transportation and land-use planning reviews. It took effect July 1, 2007.

The law directs localities to submit to VDOT, for review and comment, traffic-impact analyses for proposed developments that would affect the state's transportation system. It also requires that data from these studies be consistent statewide.

The Research Council completed a project in early 2007 recommending that VDOT enact a $1,000 fee to cover its costs for conducting these traffic-impact studies. The report also proposed that VDOT develop a longer-term fee structure to allow the agency to recover its actual costs when conducting these studies.

VDOT still has thousands of miles of undeveloped corridors and related sections across the Commonwealth that it must prioritize. The Research Council sponsored a U.Va. study that will produce a comprehensive, risk-based approach using GIS to identify and rank these corridors so VDOT can create strategies to protect them. The project's second phase will include training and implementation modules for local governments to use to apply these strategies.

VTRC collaborated with Virginia Tech on a study that found that the Roanoke logperch (*Percina rex*), a federally endangered darter endemic to Virginia, has a wider range in state waterways than previously believed. The researchers discovered this while developing new methods that VDOT could use to reduce road-building delays, and thus costs, if this species was found or suspected in streams and rivers adjacent to project sites.

As a result of this study, the Virginia Tech Cooperative Fish and Wildlife Research Unit developed an acceptable screening model that will allow VDOT to exclude reaches of certain rivers and streams from consideration as potential logperch habitat in future construction areas.

To better preserve Virginia's historical and cultural resources on VDOT's rights of way, the Research Council developed guidelines to better describe and identify these treasures, such as military earthworks, monuments, road markers and cemeteries from the 19th century and earlier.

These new protection guidelines will make it easier for VDOT to protect these state resources by reducing the amount of staff time needed to investigate them as well as subsequent project delays. They also will help VDOT, its contractors and others avoid misidentifying or damaging them and thus violating any related state or federal laws.

Research Scientist Bridget Donaldson collects water samples from a stream near a VDOT construction site.

LEGISLATIVE AND POLICY STUDIES

VTRC conducted several legislative and policy projects at the request of the VDOT, the Secretary of Transportation and the Virginia General Assembly. The results of these efforts will assist in the development of future transportation policy and legislation.

They included:

- **Three legislative studies** on the maintenance and cost impacts of overweight trucks

One study focused on overweight trucks hauling sand and crushed stone in southwest Virginia's seven coal-severance counties; a second study focused on overweight trucks used for water blasting, underground pipe cleaning and hydro-excavation trucks; and the third study focused on overweight small petroleum tank-wagon trucks.

For all three studies, the Research Council developed methods to measure the added annual maintenance cost associated with higher statutory weight allowances for each of the three types of trucks. Each methodology quantified the increase in "equivalent single axle loads," or ESALs, and a truck's annual mileage as factors in added annual maintenance cost.

- **An examination of** administrative and functional road classifications

A 2007 state law directed VDOT to examine the state and federal classifications of its roads – the administrative and functional classifications – to determine whether Virginia could reassign road segments within VDOT's current administrative categories using the functional classification of each road segment.

Virginia's administrative system is based on historic classifications and jurisdictional boundaries and lists roads as primary, secondary or urban, based roughly on their location and length. FHWA oversees the federal functional classifications, which all states also use to classify their roads – based on mobility, access to land or a combination of the two.

FHWA requires all states to functionally classify their roads. States can also have additional separate classifications, such as Virginia's administrative system that predates the federal structure.

Research Scientist Brian Diefenderfer is one of several VTRC staff members who also teach at the University of Virginia. The training of future transportation professionals is a key part of the Research Council's mission.

The Research Council study seeks to determine if and how Virginia's roads could be reassigned among the administrative categories using the functional classifications. The primary, secondary and urban elements of the administrative system will remain, but the roads within each category will be reclassified. The project will also consider what impact such reassignments might have on the state's funding formulas and mechanisms.

- **An investigation of** the environmental implications of cured-in-place pipe rehabilitation, or CIPP

This trenchless technology is widely used throughout the United States to allow the repair of existing culverts and pipes "in place." The practice alleviates the need to unearth the pipes to replace damaged sections, which, in turn, tears up the road, delays traffic, and costs more money and drivers lost time.

Typically a lining tube is saturated with a thermosetting resin – which generally contains styrene – and then installed in the existing pipe by pulling or inverting it through the pipe. The liner is expanded to the size of the host pipe and is cured, or set, to form a pipe within a pipe. Curing normally is achieved by sending heated water or steam through the pipe to set the resin.

The researchers identified and observed seven CIPP installations in surface water and stormwater conveyances during the study. VTRC is conducting this study for VDOT because there had been little research into CIPP's environmental impacts; it will be completed in 2008.

- **A review of** pedestrian and bicycle laws in Virginia and the nation

The Transportation Secretary requested this study for state legislators interested in amending these laws. The report's 16 recommendations sought to clarify ambiguities in current state laws regarding the responsibilities and duties of motorists, pedestrians and cyclists and add more definitions for various equipment and actions, in an effort to improve safety.

The Research Council reviewed laws governing pedestrian and bicycle safety throughout the nation. VTRC supports Virginia's General Assembly, Secretary of Transportation and VDOT by conducting thorough studies of various transportation policy issues.

2007 AWARDS

Individual awards

D. Stephen Lane – ASTM Award of Merit, the highest ASTM International honor for individual contributions; for leadership in and technical contributions to the Concrete and Aggregates Committee and for contributions to concrete durability and alkali-aggregate reactivity

Michael C. Brown, Ph.D., P.E. – Virginia Tech Civil & Environmental Engineering Department's Outstanding Young Alumni award winner

VDOT awards with VTRC participation

Perpetual Pavement Award from the Asphalt Pavement Alliance for the section of Interstate 81 between mile markers 314.8 and 324.9 in Frederick County.

National Partnership for Highway Quality Award, for VDOT's Route 33 West Point Mattaponi Bridge replacement project – **H. Celik Ozyildirim, Ph.D., P.E.,** and **Rodney T. Davis, Ph.D., P.E.,** led the development of the innovative infrastructure incorporated in the bridge, especially the Bulb-T, a pre-stressed concrete girder that allows for longer bridge span lengths and reduces the number of piers needed in deep water.

Transportation Research Board paper awards:

David W. Mokarem, Ph.D. and **Michael M. Sprinkel, P.E.** – Practice Ready Award for "Performance Evaluation of Bonded Concrete Overlays After 11 Years" from the Design and Construction group

M. Shabbir Hossain, Ph.D., P.E., D. Stephen Lane and **Benjamin Schmidt** – "Use Of The Micro-Deval Test For Assessing Fine Aggregate Durability" from TRB's Geology and Properties of Earth Materials Section's first best paper award, nominated by Mineral Aggregates Committee w

John S. Miller, Ph.D., P.E., and **Linda E. Evans** – "Centralized and Decentralized Multimodal Statewide Transportation Planning: A Survey of States," best paper award from Transportation System Policy, Planning, and Process Section

M. Shabbir Hossain, Ph.D., P.E., and **Mohamed Elfino** of VDOT – "Case Study: Subsurface Drainage & Premature Distresses in a Concrete Pavement in Virginia," nominated for a Practice Ready Award

VTRC researchers contributed to the development of the Bulb-T girders on the new Route 33 bridge over the Mattaponi River at West Point.

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