RESEARCH & TECHNOLOGY
TRANSPORTER

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U. S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION

FEDERAL LANDS HIGHWAY

New Drainage System Rehabilitates Concrete Tunnel Linings

In an effort to develop a better method of dealing with highway tunnel water drainage problems caused by winter freezing, Eastern Federal Lands Highway Division (EFLHD) is testing a sheeting drainage system. The system consists of a layer of geocomposite, a layer of ceramic, and a layer of polyurea elastomer. The geocomposite creates a sheet drain to catch groundwater and conduct it to longitudinal drainage pipes at the base of the lining. The sheet drain was coated with a layer of ceramic material designed to prevent the groundwater from freezing within the sheet drain. The ceramic material was coated with a layer of polyurea elastomer to enhance the visual and aesthetic characteristics of the system.

Water in tunnels often freezes because it doesn't have the chance to drain.

In the past, EFLHD engineers have addressed highway tunnel drainage water problems by constructing drain chases at joints and, in the case of irregularly shaped cracks, injecting the crack with epoxy resin or drilling drainage relief holes at intervals along the length of the crack. While these methods have produced some successful results, there have been failures as well. Drain chases are rubber or plastic pipes installed in slots in the concrete lining to capture and conduct water. One significant problem with the drain chases has been water freezing in the drain chases during winter and damaging the drain chases over time. The relief holes likewise have had water freeze as it reaches the exposed surface of the lining, thereby blocking the hole and preventing groundwater from draining as intended.

Temperature sensors have been installed in the test lining and temperature data will be recorded from December through March. The data will provide critical information regarding the effectiveness of the ceramic coating in preventing the groundwater from freezing within the drainage mat.

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The *Research and Technology Transporter* communicates FHWA research, development, and technology accomplishments, findings, information, and technology transfer opportunities. Its audience is transportation engineers and professionals in State and local highway agencies, State DOTs, Local Technical Assistance Programs, Divisions, Resource Centers, Core Business Units, academia, and the research community. The eight-page newsletter is published monthly by FHWA's RD&T service business unit. Editorial offices are housed at the Turner-Fairbank Highway Research Center. Comments should be sent to the editor at the address below. Field offices are encouraged to submit articles for publication via the appropriate agency technology leader from the editorial board listed below. The newsletter can be viewed online at www.tfhrc.gov. Subscriptions to the *Transporter* are free. Send your request to Judy Dakin at the address below, or send email to judy.dakin@fhwa.dot.gov.

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New CSL Method Makes Process More Accurate

Structural defects such as honeycombing, or soil inclusions that occur during concrete placement in deep foundations, may result in major stability or safety issues. Obtaining accurate and timely information on the integrity of concrete structures, such as drilled shaft foundations, is essential for project progress and success. New techniques for using cross-hole sonic logging (CSL) have shown conclusively that tomographic imaging can accurately depict the geometry, size, and location of anomalous zones within a pier structure.

CSL is a nondestructive evaluation process that uses geophysical wave propagation techniques to characterize concrete structure integrity in bridge piers within days after placement of the concrete. CSL has become the standard method within the Federal Highway Administration and several State Departments of Transportation. Although the CSL method has been demonstrated as a valid assessment tool, the currently used full waveform and XY plots are difficult to interpret. It can be difficult to use these plots to determine the specific geometry and location of defects within a pier.

Central Federal Lands Highway Division has recently completed a research project using CSL data presentation with 3-D images that vastly improve the ability to interpret concrete pier integrity. Research data taken from 36 shafts has shown that refining CSL data presentation with tomographic techniques and 3-D color-coded imaging simplifies concrete integrity characterization and ultimately reduces both costs and risk.

Results and recommendations from this project are summarized in a research report titled *Crosshole Sonic Logging and Tomographic Imaging Survey to Evaluate Integrity of Deep Foundations-Case Studies.* The report is available for distribution from the FHWA Central Federal Lands Highway Division office.

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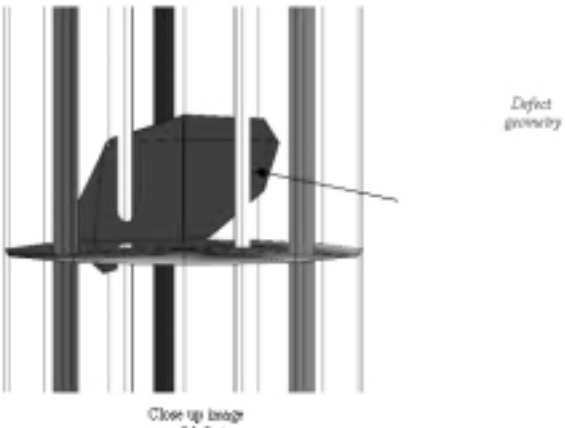
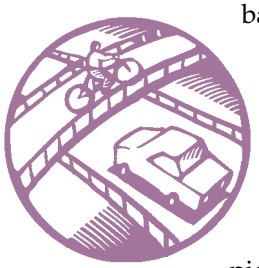


CSL generated graphics like these are much easier to interpret.

SAFETY

Masonry Guardrail Passes Test

A rough stone masonry guardrail passed the pickup truck test required to meet Test Level-3 of NCHRP 350. The traffic barrier was crash tested as part of a series of tests being conducted to develop aesthetic traffic barriers for the Federal Lands Highway Core Business Unit. The Office of Safety R&D is having the tests carried out at the Texas Transportation Institute's Proving Grounds. The Eastern Federal Lands Highway Division did the detailed design of this barrier, which is intended for use by all of the Federal Lands Highway agencies.



The rough stone masonry guardrail successfully redirected a pickup truck to pass Test No. 3-11 in NCHRP 350. The pickup truck hit the barrier at 100 km/h and 25 degrees and was redirected upright. The masonry guardrail sustained cosmetic damage.

The rough stone masonry guardrail is a rigid barrier consisting of a precast reinforced concrete core that is faced and capped with natural stone and mortar. This gives it the appearance of a natural stone masonry wall.

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Rough stone masonry guardrail after the crash test.

Roadway Hardware Management Systems: Is there a need for Assistance?

Guardrails, signs, pavement markings, and numerous kinds of safety devices are an important part of every modern highway. These devices are often referred to as roadway hardware. Every year, hundreds of millions of dollars are spent installing, repairing, upgrading, and replacing this hardware. In recognition of this demand on resources, AASHTO has created a special ad-hoc steering committee to determine if current roadway hardware management systems need to be enhanced. This ad-hoc committee consists of State maintenance and traffic experts and is chaired by Michael Crow from the Kansas Department of Transportation.

Installing, repairing, upgrading, and replacing roadside hardware such as this guardrail requires hundreds of millions of dollars annually.

The steering committee is currently conducting a survey of State DOTs to establish a baseline of current practices and to determine needs and interest in enhancements. This survey will collect information on signs, traffic signals, lighting, supports and structures, guardrails, barriers and crash cushions, pavement markings, and traffic detectors. Based on the results of the survey, the steering committee will determine if assistance is needed by the States in any of these areas, such as the development of a synthesis of best practices or a set of guidelines for specific management systems.

There are many issues related to roadway hardware. Costs for installation and maintenance vary widely with the selection of equipment, locations, ambient conditions, and accessibility. Estimating the life of a guardrail, sign, or a crash cushion is difficult but essential for predicting future budget needs. Heavy traffic restricts available hours for repair work and increases liabilities on highways. State highway departments cannot risk using a "wait and see" approach to hardware maintenance. They need to know what to expect and how to deal strategically with problems before they arise.

With years of experience in pavements and bridges, States have found that management systems can help address these kinds of problems. By predicting operations and maintenance costs, States can more accurately establish work plans and budgets to replace hardware at the appropriate time and at the least cost.

The AASHTO survey to determine needs and interests is the first step in a program to research and develop tools that assist States in managing their vast inventories of roadway hardware.

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INFRASTRUCTURE

Engineers Coordinate Pavement Program

Pavement and materials engineers from 13 States, resource centers, Federal Lands, Offices of Pavement Technology and Asset Management, TFHRC, and the National Highway Institute converged in Atlanta to strengthen FHWA's pavement and materials team and to establish a common vision. At the meeting, representatives developed a framework to identify the needs of field offices, and drafted a work plan to help the agency achieve its strategic goals.

FHWA pavement engineers met in Atlanta to coordinate the agency's pavement program.

James Erickson, Southern Resource Center Manager, opened the meeting by welcoming the group and encouraged participants to work together and develop strategies to achieve the agency's goals. Technical experts gave presentations showcasing pavement smoothness, the AASHTO 2002 Pavement Design Guide, asset management, Superpave, LTPP, and performance related specifications. Representatives from the private sector presented their projections for the future of the pavement and materials industry.

To strengthen FHWA's pavement and materials delivery program, teams were created in the areas of pavement preservation, best practices, pavement smoothness, and the AASHTO 2002 Pavement Design Guide.

The framework drafted at the meeting includes an outline for each resource center to host a pavement and materials team meeting to identify field needs on a yearly basis. These needs will then be presented to a national steering committee for consideration as part of FHWA 's pavement work plan.

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OPERATIONS

CLAIRE Comes to U.S.

New traffic management software that can detect congestion and recommend ways to mitigate it is being tested by FHWA. The software is called CLAIRE and it was developed by the French ministry of transportation.

CLAIRE is an expert decision making system for real time traffic management developed in France between 1984 and 1990. CLAIRE can detect the onset of traffic congestion, determine its cause, and predict how it might develop. Using historical data and real time data, CLAIRE recommends solutions to relieve congestion. Traffic engineers throughout its development have validated the methodology used by CLAIRE. A simulation assessment of CLAIRE has demonstrated clear reductions

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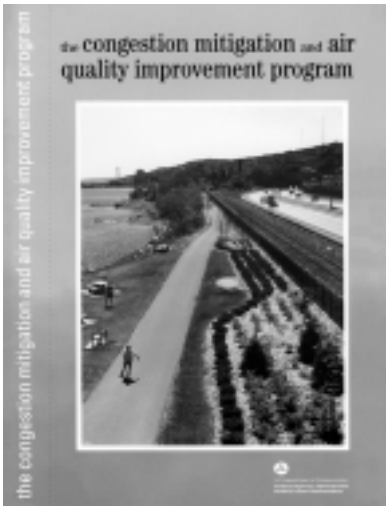
ENVIRONMENT

New Publication Explains CMAQ

An informative brochure is now available that explains to laymen and technicians alike the history of the CMAQ program and how to access this highly innovative transportation funding source. The newly released publication, titled *The Congestion Mitigation and Air Quality Improvement (CMAQ) Program* (FHWA-EP-00-020), was published by FHWA and the Federal Transit Administration (FTA). The publication updates information contained in previous CMAQ brochures and was expanded to include information regarding the program under TEA-21 and the planning process for metropolitan planning organizations.

The document is intended for transportation planners, project applicants, environmental stewards, and the general public. It provides background and general information regarding the CMAQ program and more specific information concerning funding, eligibility, the project approval process, and lists contacts for more information.

The brochure will also soon be available on the FHWA Office of Planning and Environment Web site at: *http://www.fhwa.dot.gov/environment/cmaq.htm*. We hope that this document is useful and informative. If you have any questions regarding the publication, please contact:



The new publication is available online at www.fhwa.dot.gov/environment/cmaq.htm.

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for drivers in travel time, number of stops, and fuel consumption. CLAIRE has been operating as an automatic system in Paris since 1990.

CLAIRE uses symbolic calculus and deductive methods to process quantitative and/or qualitative information. CLAIRE can be divided into two subsystems. The first subsystem runs online and puts into effect procedures to remedy the current traffic conditions. The second subsystem runs off-line and consists of a congestion recognition function and a learning function.

CLAIRE helps the basic control system adapt to the congested traffic conditions. When the congestion is diminished, CLAIRE returns the control to its initial state. CLAIRE manages a long-term memory of previously recorded congestion and gridlock scenarios and is capable of recognizing previously recorded traffic situations. A history of the congestion problem can be generated off-line and the learning function can broaden the solution database with newly developed congestion management strategies.

FHWA will be implementing CLAIRE in Houston to mitigate congestion on freeways and arterials due to I-10 (Katy Freeway) reconstruction. CLAIRE will be implemented along with FHWA's Traffic Estimation and Predictions System (TrEPS) in order to develop route diversions due to the freeway reconstruction and to make CLAIRE "smarter" by providing the traffic volume prediction from TrEPS. A similar CLAIRE implementation without TrEPS is also planned for the arterial system in Los Angeles.

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INTERNATIONAL

European Work-Zone Practices Yield Ideas for U.S. Roads

FHWA Office of International Programs has just released a report titled *Methods and Procedures to Reduce Motorist Delays in European Work Zones.* Work-zone delays are an increasing irritant and danger for U.S. motorists. In 1997, more than 600 fatalities occurred in work-zone crashes, at a high personal and societal cost.

To observe how other countries manage traffic flow through temporary work zones, FHWA and the National Cooperative Highway Research Program sponsored a scanning tour to give U.S. highway agency and contractor representatives a first-hand look at operations. The tour took place in May 1999, and representatives of FHWA, State DOTs, and private contractors visited locations in Cologne, Germany; the Hague, the Netherlands; Antwerp, Belgium; Edinburgh, Scotland; and Paris, France.

The team noted that European agencies focus a great deal of attention and resources on evaluating how the project will affect their customers—the highway users—and then on developing and implementing strategies to minimize those effects. They also place a great deal of emphasis on developing and implementing a communications plan to inform the public about work zones and provide alternative routes well in advance of the project start date and on keeping the public informed about real-time traffic situations. Agencies and contractors extensively use ITS technologies to communicate with the public.

Based on their observations, the scanning team developed several recommendations for improving traffic flow and safety in U.S. highway work zones. The first is that lane rental charges can provide significant incentives for shaving time from construction projects and ensuring that construction is done right the first time. The second is that by narrowing the lanes in work zones, agencies can maintain the same number of lanes and thus minimize delays. Narrower lanes have the added benefit of encouraging traffic to slow down. New construction should include shoulders with adequate structural capacity so that traffic can be rerouted onto the shoulder during future construction and maintenance operations.

The report is available on the Internet at *www.international.fhwa.dot.gov.* Hard copies are available by contacting *international@fhwa.dot.gov.*

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In May 1999, FHWA led a scanning tour to see how other countries manage traffic flow through temporary work zones.

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PROFESSIONAL DEVELOPMENT

National Highway Institute Holds First Instructor Conference

For the first time in its 30-year history, the National Highway Institute (NHI) held an Instructor Conference. The conference, which was held October 18–20 in Colorado Springs, CO, was designed as a forum for open communication and exchange of information to help NHI's customers.

Attendees were approximately 150 contractors, subcontractors, and FHWA staff directly involved in the development and delivery of NHI training programs. The forum provided an opportunity for the participants to receive FHWA updates, interact with NHI staff, and to take part in workshops designed to improve instructor effectiveness.

Speakers at the conference included Dr. Donald Kirkpatrick, Professor Emeritus at the University of Wisconsin-Milwaukee, who talked on the importance of training evaluation and how it can be conducted effectively. Motivational speaker Jim Bagnola, a senior partner in The Leadership Group, led a discussion on "Jump-starting the Adult Mind." Professor Karen Medsker, chair of the Human Resources Department of the School of Business at Marymount University, spoke on Instructional System Design. Pennsylvania State University Professor Art Miller spoke about distance learning.

Six interactive workshops were held to provide an opportunity for conference participants to refine their skills in instructional design and delivery. These workshops covered various topics, including: instructional techniques and skills in distance learning, effective use of visual media, learning and the physical aspects of training, and assessing your presentation style. The conference concluded with a town meeting, in which participants gave the NHI Director and staff feedback as to how NHI programs and services can be improved.

According to the Director of NHI, Moges Ayele, "the conference provided an excellent opportunity for NHI staff to interact with NHI instructors who are directly involved in the delivery of the courses. It helped us identify areas where we need to make improvements to ensure NHI's effectiveness."

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