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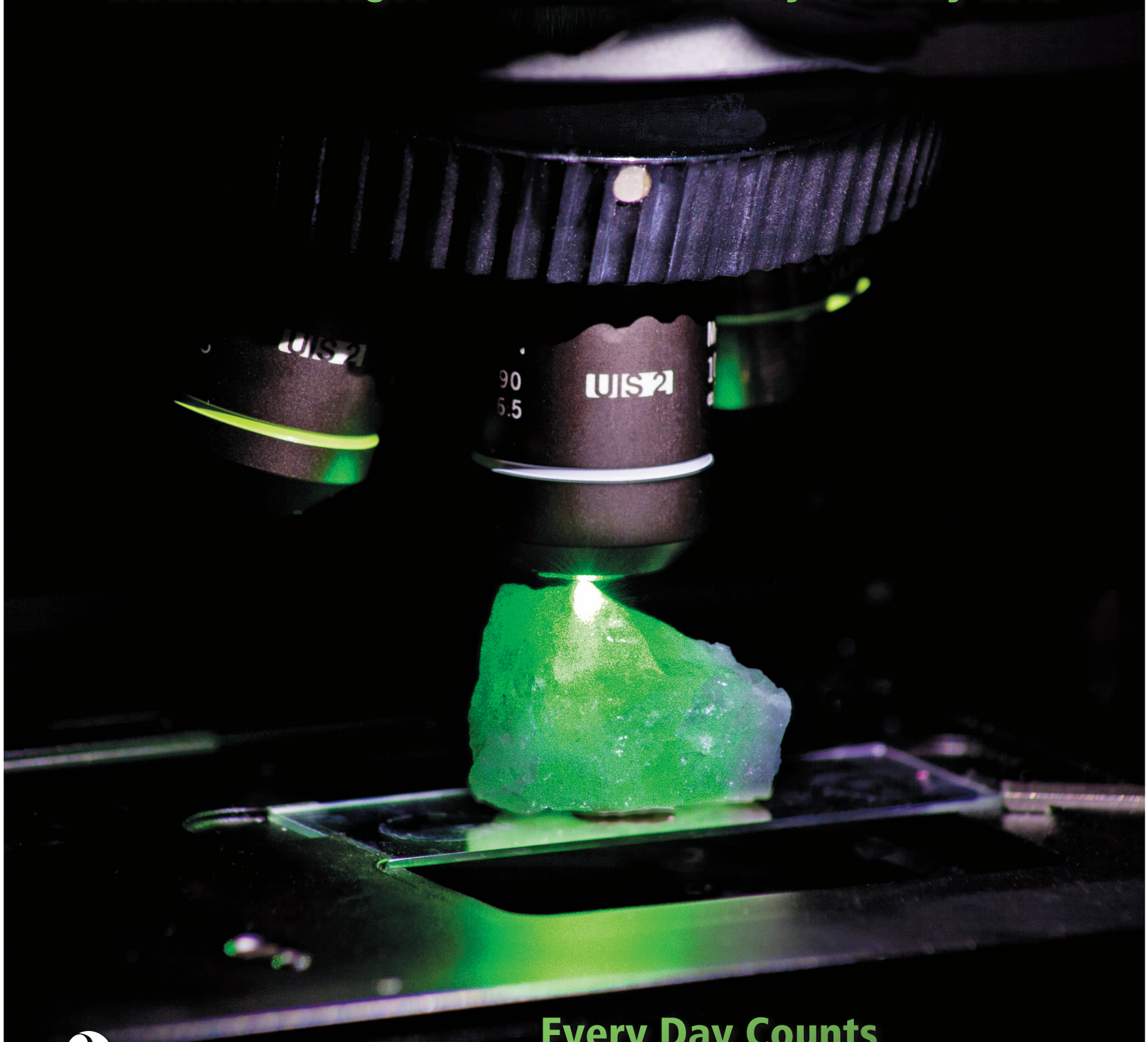

U.S. Department of Transportation

Federal Highway Administration

Every Day Counts
Pedestrian Focus States
Chemistry of Roads

Public Roads

—featuring developments in Federal highway policies, programs, and research and technology—

January/February 2012 www.fhwa.dot.gov Vol. 75, No. 4

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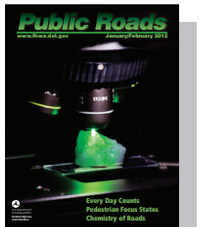

Front cover—A powerful 532-nanometer-wavelength green laser in a Raman spectrometer illuminates a sample of quartz aggregate at the Federal Highway Administration's (FHWA) chemistry lab. The sample scatters the laser's incident photons, causing a shift in its wavelength. FHWA researchers are developing a test method for identifying alkali-silica reactivity gels, which are a distress mechanism in concrete. For more information, see "Why Does FHWA Have a Chemistry Lab?" on page 19 in this issue of PUBLIC ROADS. *Photo by Keith Roselle, ICF International.*

Back cover—Shown here are some of the overpasses that make up the state-of-the-art Marquette Interchange in the heart of downtown Milwaukee, WI. Located at the junction of I-94, I-43, and I-794, the interchange carries more than 300,000 vehicles daily, nearly half of the State's commercial and tourism traffic. The project opened to traffic in 2008, 3 months ahead of schedule and $25 million under budget, and received numerous national awards. *Photo: Wisconsin Department of Transportation.*

U.S. Department of Transportation
Federal Highway Administration

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The editorial office of *Public Roads* is located at the McLean address above.
Phone: 202–493–3398. Fax: 202–493–3475.
Email: paula.magoulas@dot.gov.

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Guest Editorial

Focusing on Performance Management

The highway system in the United States is critical to the Nation's vitality, economic growth, and overall well-being. This system, which serves billions of trips by highway users annually, is recognized as one of the preeminent roadway networks in the world. The National Highway System, a critical component of that network, stretches more than 160,000 route miles (256,000 kilometers) around the country. It includes the interstate system as well as other routes essential to national defense, mobility, and commerce. Although the system represents only 4 percent of the Nation's highway mileage, it supports nearly 45 percent of travel on U.S. roadways.

For this system to continue to serve the Nation and the global economy, it must provide for safe, efficient, and effective travel. Achieving this outcome has become a greater challenge today as the system ages and highway agencies with dwindling financial resources are stretched to maintain and upgrade it. Recognizing this challenge, many States, local agencies, and planning organizations have embraced the concepts of performance management. They have established clear performance goals for the system and are using sound performance metrics to drive their investment and strategic decisionmaking.

State department of transportation publications, such as Washington State's *Measures, Markers and Mileposts (The Gray Notebook)* report; Missouri's *Tracker* report and tool; and San Francisco, CA's long-range plan, *Transportation 2035 Plan for the San Francisco Bay Area: Change in Motion*, are all examples of deliberate efforts to plan, program, and track highway investments and strategies to achieve desired performance outcomes.

This same commitment to performance management is also critical today at the national level to ensure that performance outcomes are achieved for the National Highway System and other significant roadway systems. Applying performance management concepts at the national level will challenge Federal, State, and local agencies to work together to invest in the highway system to achieve national performance expectations. The National Surface Transportation Policy and Revenue Study Commission, formed under the Safe, Accountable, Flexible, Efficient Transportation Equity Act—A Legacy for Users (SAFETEA-LU), recognized this need and challenge by stating, "Developing performance standards and integrating them into a performance-driven regimen that would be applicable to all States and metropolitan areas will be a challenge since local conditions are so different, but the rewards will be worth the effort."

To overcome these challenges, the Federal Highway Administration and Federal Transit Administration are partnering with the American Association of State Highway and Transportation Officials, Association of Metropolitan Planning Organizations, American Public Transportation Association, and other organizations to take the necessary steps today to bridge gaps that are preventing transportation agencies from managing performance effectively at a national level. These steps include the development of consistent performance metrics, new performance modeling tools, improved information and management systems, new benefit/cost methodologies and tools, more cost-effective and reliable equipment for monitoring performance, and improved analytical and reporting tools.

Together, the completion of these efforts will enable Federal, State, and local agencies and planning organizations to work collaboratively to optimize available resources in a manner that maximizes performance outcomes for the highway system. These initiatives will enable the agencies to speak collectively, as a Nation, on how the transportation community can improve and sustain the performance of the U.S. highway system.

Peter J. Stephanos, P.E.
Director, Office of Pavement Technology
Federal Highway Administration

This FHWA initiative aims to identify and deploy innovations that can shorten project delivery time, enhance roadway safety, and protect the environment.

Every Day Counts

by Wendy McAbee

(Above) Workers on a Wisconsin Department of Transportation project on State Highway 55 in the Menominee Indian Reservation are constructing an overlay using the Safety Edge℠, one of several technologies FHWA is promoting through Every Day Counts.

Today, the transportation industry faces an unprecedented list of challenges. The public wants greater accountability for how tax dollars are spent. Tighter budgets mean highway agencies need to work more efficiently, do more with less. To succeed in a tough economic climate, highway agencies need to make greater use of promising technologies, and minimizing congestion demands finding innovative ways to shorten project delivery times. At the same time, agencies continue to look for ways to make roads safer, work better, and last longer, while preserving the country's natural resources for future generations.

To help meet these challenges, Federal Highway Administrator Victor Mendez launched the Every Day Counts initiative in November 2009. The initiative is an effort to bring a better, faster, and smarter approach to highway and bridge construction.

"The President has challenged us to out-innovate, out-educate, and out-build the rest of the world in order to 'win the future,'" Administrator Mendez says. "[The President] indicated that infrastructure is at the heart of that effort and that we can't move people and goods safely and efficiently or compete with other economies if we don't have a transportation network that's up to the job."

Every Day Counts acknowledges that a strong infrastructure is vital to winning the future. Infrastructure projects create jobs today and can enable people and goods to move efficiently in the 21st century. To help stakeholders across the country implement Every Day Counts initiatives, the Federal Highway Administration (FHWA) has adopted a new mindset that Administrator Mendez calls "leaning forward." He describes this mindset as similar to a waiter who not only presents the menu but makes recommendations and solicits feedback from diners.

FHWA presented its "menu" of initiatives and recommendations during 10 regional innovation summits held across the country in fall 2010 engaging transportation stakeholders, such as Federal, State, and local agencies, as well as industry partners. Following the summits, all 50 States, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and the three FHWA Office of Federal Lands Highway divisions identified a selection of Every Day Counts initiatives to implement.

Shortening Project Delivery

FHWA organized Every Day Counts around three main objectives: shortening project delivery, enhancing the safety of roadways, and protecting the environment. With these objectives in mind, FHWA program offices, the American Association of State Highway and Transportation Officials (AASHTO), and other partners and stakeholders collaborated to develop a toolkit containing approaches that could shorten project delivery, identified innovative contracting methods, and highlighted initiatives that could help to deploy market-ready technologies rapidly.

The toolkit for shortening project delivery aims to eliminate time-consuming, duplicative efforts in the planning and environmental review processes and to expand the use of regulatory flexibilities afforded under current laws. This toolkit includes the following initiatives.

Expanding the use of programmatic agreements. The continued and expanded use of programmatic agreements, where procedures have been standardized and agreed upon, has proven effective in saving time. For example, the Nevada Department of Transportation worked with the U.S. Fish and Wildlife Service on a programmatic agreement to provide biological opinions (BOs) for their transportation projects. The process of completing a BO generally required 135 days. The programmatic BO was recently applied to two projects saving 97 days and 85 days respectively. The goal of this initiative is to identify and assist in the expansion of new and existing programmatic agreements at the regional or national levels.

Use of in-lieu fees and mitigation banking. In projects that will affect U.S. waterways, the permitting process under Section 404 of the Clean Water Act currently constitutes a major component of the project development and delivery process. In order to save time and expedite project delivery, this initiative proposes expanded use of in-lieu fees and mitigation banking. In-lieu fees are those charged to a permittee to perform various environmental enhancement activities throughout an entire watershed rather than at one particular site. Mitigation banking is restoration, establishment, enhancement, or preservation of wetlands, streams, or other resources for the purpose of offsetting unavoidable adverse impacts related to a highway project. Through this initiative, FHWA is encouraging highway agencies to use both of these approaches where allowed under existing statutes, FHWA regulations, State laws, and court decisions.

Legal sufficiency enhancements. Decisions made early in planning and project development often are the root cause of problems identified later in the environmental review process when National Environmental Policy Act (NEPA) and Section 4(f) (of the Department of

Use of in-lieu fee programs or mitigation banking credits can help mitigate adverse impacts on wetlands, such as this one, and expedite delivery of highway projects.

Timely identification, verification, coordination, accommodation, and/or relocation of utilities such as the ones shown here are key factors that State and local agencies identify as cause for delays in highway projects. Taking advantage of regulatory flexibilities in utility relocation can help speed up the process.

Transportation Act of 1966) documents undergo legal scrutiny. Consultation with FHWA environmental attorneys at early decision points can help decisionmakers avoid problems later, saving time and costs.

Enhanced technical assistance. FHWA will provide additional technical assistance to identify major challenges facing ongoing projects requiring environmental impact statements and implement solutions to resolve project delays where feasible. Teams will focus on facilitating interagency coordination and collaboration to resolve outstanding issues and provide peer-to-peer activities, workshops, training, and specialized onsite assistance.

Clarifying the scope of preliminary design. This initiative identifies the amount of design work allowable under current law prior to completion of the NEPA environmental review process, regardless of the contracting mechanism. FHWA has issued Order 6640.1A Policy on Permissible Project Related Activities During the NEPA Process to provide guidance and consistency.

Planning and environmental linkages. This initiative will set up a framework for considering and incorporating planning documents and decisions from the earliest stages of project planning into the environmental review process. Linking planning and environmental considerations can lead to a seamless decisionmaking process that minimizes duplication of effort, promotes environmental stewardship, and reduces delays in project implementation.

Flexibilities in right-of-way. The right-of-way (ROW) acquisition process is a major component in the project development process. By employing regulatory flexibilities already provided in statutes and FHWA regulations, agencies can achieve significant time savings. For example, waiver valuations allow the State departments of transportation (DOTs) to waive appraisals for properties that are valued at less than an established dollar amount resulting in cost avoidance of the appraisal fee and time savings in the appraisal process. This initiative can underline opportunities for improved coordination of ROW activities with other key project development actions in preliminary design.

Flexibilities in utility accommodation and relocation. FHWA estimates that half of all highway and bridge projects eligible for Federal funding involve the relocation of utility facilities. Construction generally takes longer and costs more when utilities are relocated. The initiative spotlights existing flexibilities under Federal law and FHWA regulations and describes techniques such as master utility agreements and preapproved utility contractor lists that foster effective utility coordination during project development that warrant more widespread use.

According to Brian D. Hasselbach, environmental and ROW programs manager at the FHWA Montana Division Office, his State is undertaking a number of these initiatives, including planning and environmental linkages, streamlining the development of NEPA environmental impact statements, and using flexibilities in the ROW and utilities processes. "Since 2002, MDT [the Montana Department of Transportation] has used corridor studies to provide an effective linkage between its planning and project development processes," Hasselbach says. "The studies typically are crafted with the involvement of a multitude of stakeholders, including Federal and State resource and transportation agencies, tribes, local agencies, and the public. Consequently, they result in a more comprehensive evaluation of the transportation needs in a given area."

He continues, "This approach yields a number of significant benefits. Integration of the planning and environmental processes leads to better, more informed decisionmaking, which reduces duplication of analysis and reduces the time associated with developing a project. The planning studies afford the public a greater opportunity to be engaged in the decisionmaking process and involve resource agencies and other stakeholders much earlier in the project development process. This approach often leads to a more comprehensive analysis of environmental impacts and considerations, and, as a result, leads to more effective outcomes. MDT's planning corridor studies have proven to be an effective tool in streamlining the development of projects, while further enhancing our collective stewardship responsibilities of the natural and built environments."

Accelerating Project Delivery

For the objective of accelerating project delivery, FHWA and its partners settled on recommending two innovative contracting methods that States can adopt as standard business practices.

Design-build contracting. Design-build contracting is a method of project delivery in which the design and construction phases are combined into one contract, eliminating the separate bid phase and allowing certain aspects of design and construction to take place at the same time. This approach can provide significant time savings compared with the traditional design-bid-build approach, where the design and construction phases must take place sequentially.

Construction manager–general contractor. Between traditional design-bid-build and design-build lies an approach known as construction manager–general contractor. In this scenario, the project owner hires a general contractor or design firm to serve as the construction manager, placing responsibility for design review, design modifications, system integration, and construction with that single contractor. As with the design-build approach, agencies can achieve time savings because of the contractor's ability to undertake a number of activities concurrently.

Accelerating Technology And Innovation Deployment

Accelerating technology and innovation deployment is about taking effective, proven, and market-ready technologies and putting them into widespread use. The focus of these initiatives is to advance 21st century solutions to improve safety, reduce congestion, and keep people and goods moving. With support from stakeholders, FHWA culled the following technologies from a list of more than 30.

*The Safety Edge*SM. A simple but extremely effective treatment for pavement edges, called the Safety Edge℠, can help save lives by enabling drivers who stray off the road to return to the travel lane safely. Rather than leave a vertical dropoff at the pavement shoulder, the Safety Edge℠ shapes the edge of the pavement to an angle between 30 and 35 degrees, which makes it easier for errant drivers to reenter the roadway safely.

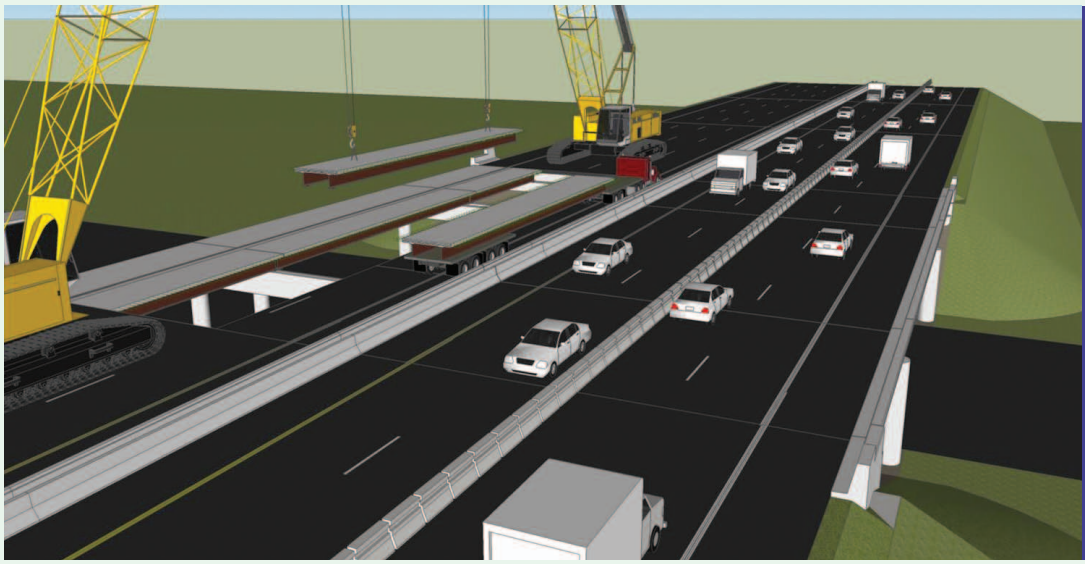
Donna J. Hardy, the safety programs engineer with the West Virginia Department of Transportation's Traffic Division, says the Safety Edge℠ is "a much needed technology" for the safety of roadways in her State. "Many of West Virginia's roadways are literally cut into the side of mountains, and runoff from the mountains creates deep roadside ditches," she says. "Motorists have little area to recover once they leave the roadway, but the Safety Edge℠ can significantly reduce the occurrence of a severe crash."

According to Hardy, the department is working with industry to test two variations of a performance specification to achieve the Safety Edge℠. "We have either awarded or are currently bidding eight projects with the two specifications—four of each—and will use the lessons learned to develop a final specification and policy for 2012," she says.

Prefabricated bridge elements and systems. With prefabricated bridge elements and systems, many time-consuming construction tasks no longer need to be completed sequentially. An old bridge can be removed overnight and the new bridge put in place the next day.

Geosynthetic reinforced soil, integrated bridge system. Unlike conventional bridge support technology, the geosynthetic reinforced soil (GRS) integrated bridge system (IBS) uses alternating layers of compacted granular fill material and fabric sheets of geotextile reinforcement to provide support. The technology offers advantages in the construction of small bridges (less than 140 feet or 42.5 meters) in particular, including reduced construction time and cost savings from 25 to 60 percent compared to conventional construction methods. A GRS-IBS can be built using traditional equipment and materials, and facilitates design flexibility conducive to construction under variable site conditions, including soil type, weather, utilities and other obstructions, and proximity to existing structures.

Warm-mix asphalt. Warm-mix asphalt (WMA) is the generic term for a variety of technologies that enable construction crews to produce and then place asphalt on the road at lower temperatures than is possible using conventional hot-mix methods. In most cases, the lower temperatures result in significant cost savings and reduced greenhouse gas emissions because less fuel is required to achieve and maintain the temperatures for warm-mix paving. WMA also has the potential to extend



Victoria Sheehan, Massachusetts DOT

This digital rendering shows cranes lowering prefabricated bridge elements—an accelerated construction technology—into place on a bridge project on I–93 in Massachusetts.

the construction season, enabling agencies to deliver projects faster. By September 2011, more than 40 States had constructed WMA projects, with 14 adopting specifications to accommodate the technology.

Adaptive signal control technology. Conventional traffic signal systems use preprogrammed, daily signal timing schedules. But poor signal timing can contribute to traffic congestion and delay. Adaptive signal control systems coordinate the control of traffic signals across a signal network by adjusting the lengths of signal phases based on prevailing traffic conditions. This improves travel time reliability, reduces congestion, and creates smoother traffic flow.

Regional Summits

After deciding which innovations to promote through Every Day Counts, FHWA's first hurdle was preparing to deliver these innovations. This step required finding champions within the agency, assembling deployment teams, training the teams on the technologies and best practices to deploy the innovations quickly, and building an implementation plan. The next hurdle was how to deliver the information to State DOTs and industry partners. The solution: A series of 10 regional summits organized to bring together agencies experiencing similar challenges and with common interests and needs. FHWA invited Federal, State, and local agency leaders and technical experts, the industry, and other stakeholders and partners with direct involvement in the delivery of Federal-aid projects to participate in each 2-day summit. The emphasis was on inviting key frontline officials directly involved in the project delivery process.

Day one of each summit opened with a plenary session that included a welcome message from Administrator Mendez. He provided an overview of Every Day Counts and described the agency's vision for the anticipated outcomes. Next, Deputy Administrator Greg Nadeau introduced the initiative more fully, explaining the Every Day Counts model and the importance of partnerships and performance-based outcomes. Then, representatives from AASHTO's leadership discussed what the States could expect from Every Day Counts in terms of tangible benefits to their DOTs and highway users. The opening plenary session concluded with a question-and-answer period. The afternoon sessions featured concurrent presentations by representatives from each of the FHWA deployment teams made up of employees from various program offices, who shared information on their respective initiatives, including the benefits and current deployment status.

Day two began with concurrent presentations on the various initiatives, followed by caucus meetings specific to each State. All attendees from a given State—whether from the DOT, local agencies, consultants, or contractors—sat down to discuss which initiatives they thought would most benefit their respective State. The FHWA division administrators facilitated the caucuses for their States.

Each attendee at the regional summits walked away with homework, too. Their assignment was to form State Transportation Innovation Councils to provide leadership for the Every Day Counts initiative in each State. The division administrator for each State and his or her equivalent at the State DOT will lead the councils, which will consist of a diverse representation of local stakeholders. The councils will provide leadership to the individual initiative teams, ensure deployment of the selected initiatives, and monitor performance.

In keeping with the Administrator's "leaning forward" approach, the FHWA division offices are responsible for supporting the State DOTs by offering recommendations to help the States in their Every Day Counts activities. As members of deployment teams, the division offices work with FHWA headquarters and Resource Center personnel to provide training and guidance directly to the State DOTs to help them achieve the goals laid out in their action plans.

"The Florida DOT and the Federal Highway Administration have a great track record of working together to bring groundbreaking concepts into the Federal-Aid Highway Program," says Karen Brunelle, director of planning and the environment in the FHWA Florida Division Office and that State's Every Day Counts coordinator. "Florida has already taken a proactive approach by placing 580,000 tons of warm-mix asphalt, saving $1.5 million [$3.50 per gallon average fuel price] on 428,695 gallons of fuel. In addition, Florida's Efficient Transportation

These workers are constructing a geosynthetic reinforced soil bridge abutment, one of the technologies FHWA is encouraging for rapid deployment.

Decision Making Tool has saved the State $16.3 million and 48 years of project development time. And the design-build contracting method has helped speed the delivery of dozens of traffic safety projects. The Florida DOT is already working with the FHWA Florida Division Office on statewide policy changes regarding the Safety Edge℠ and identifying projects for the implementation of prefabricated bridge elements and systems and GRS."

Getting the Word Out

In addition to the regional summits, FHWA is using a variety of other avenues to deliver training and guidance on Every Day Counts. For example, the team that is focused on accelerating project delivery is using a format similar to the regional summits and hosting peer exchanges on the construction manager–general contractor initiative. A recent peer exchange in Denver, CO, brought together 65 attendees from the Western States to hear perspectives and best practices from DOTs with experience using the construction manager–general contractor approach. Attendees examined case studies and participated in group exercises.

A second construction manager–general contractor peer exchange is in the works for the Eastern States and their partners. In addition, FHWA hosted a similar workshop in the Northeast in early 2011 regarding the use of the design-build method.

Also, the FHWA Resource Center is using webinars to expedite dissemination of information on the prefabricated bridge elements and systems initiative. The 2-day webinar consists of a series of 12 modules that cover everything from decisionmaking tools to design examples and connection details. The target audience for this training includes bridge and construction engineering staff from State, regional, and local transportation agencies, as well as consultants and the contracting industry. States can arrange one-on-one training and guidance for any of the initiatives by contacting their FHWA division office.

Making It Stick

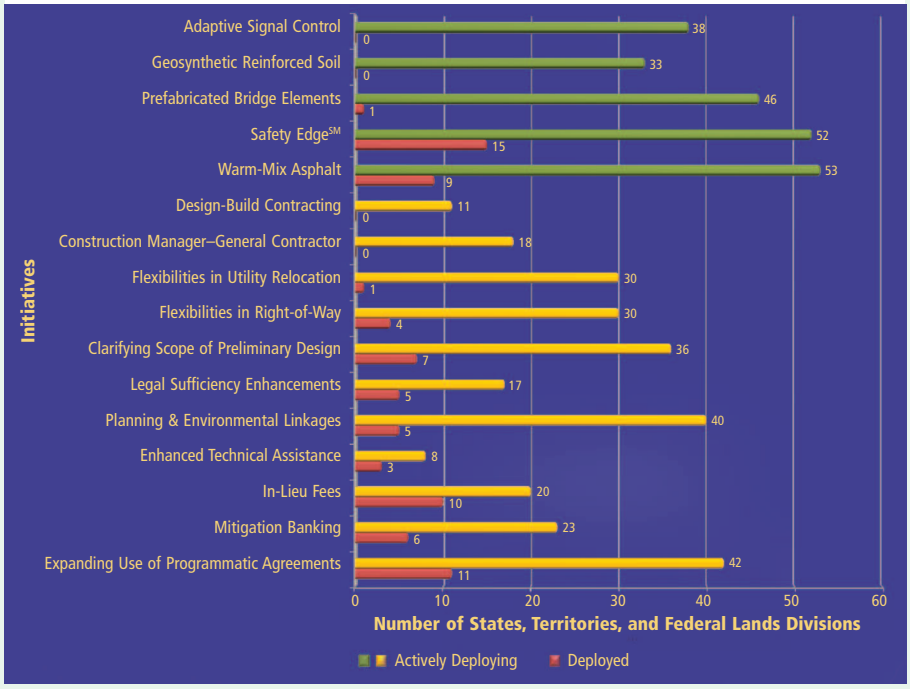
Not every initiative will add value to every project. But having access to the flexibilities and technologies available through Every Day Counts can help highway agencies add value or expedite project delivery where appropriate. The long-term goal of Every Day Counts is to institutionalize these flexibilities and innovative technologies by incorporating them into the standards, specifications, and manuals that highway professionals use every day. Many of the initiative's national performance goals reflect the effort to institutionalize these approaches.

For example, a performance goal for the geosynthetic reinforced soil initiative is to have 20 States adopt the GRS-IBS specifications and special provision within their standard bridge documents by June 2012. Similarly, the planning and environmental linkages initiative seeks to implement a questionnaire or equivalent into standard operating procedures in 50 percent of State DOTs by December 2011.

FHWA is measuring progress toward these milestones on a quarterly basis using Microsoft® SharePoint®. The software's online survey tool enables users to answer a string of questions that can gather both qualitative and quantitative data, with each successive question being determined based on a user's answer to the previous question. In this way, users answer only those questions that are applicable to their particular situations.

In the end, Every Day Counts is about embracing a culture of innovation. Not just leaning forward, but looking forward, soliciting feedback, measuring success, and making *every day count*.

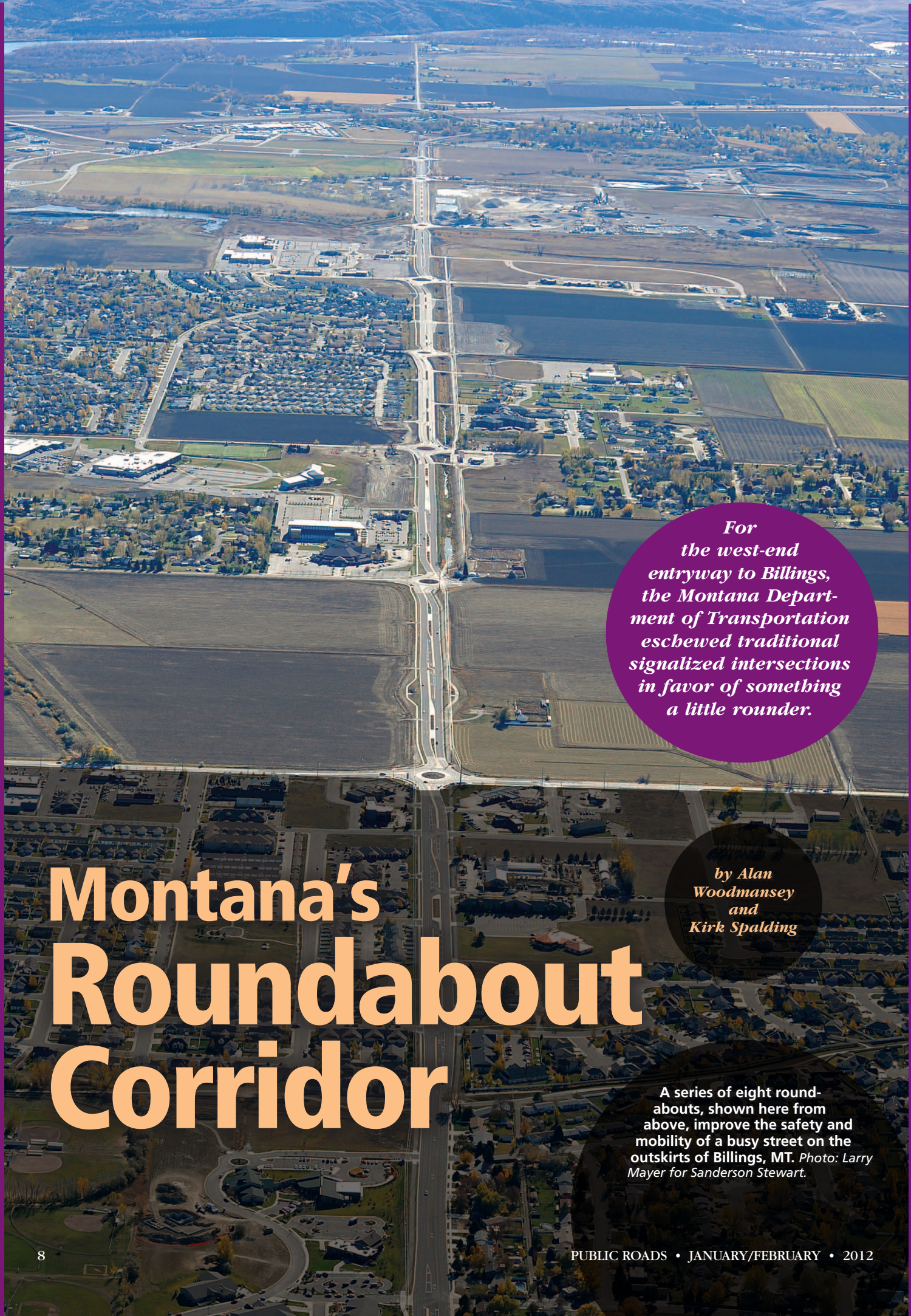
Implementation Status of Every Day Counts



The green bars represent the number of States, territories, and Federal lands divisions actively deploying the specified technology initiatives, while the yellow bars represent the number actively deploying the indicated initiatives to shorten project delivery. The red bars show the number of initiatives that are fully implemented and currently meet the national performance goal set for those initiatives. *Source: FHWA.*

Wendy McAbee is coordinator of the Every Day Counts initiative in the FHWA Office of the Deputy Administrator. She works with the FHWA initiative deployment teams, program offices, division offices, and the Office of Federal Lands Highway in support of the Every Day Counts initiative. She earned a bachelor's degree in civil engineering from Saint Martin's University in Washington State and is a licensed professional engineer and certified project management professional.

For more information, visit www.fhwa.dot.gov/everydaycounts or contact Wendy McAbee at 202-366-6006 or wendy.mcabee@dot.gov.



For the west-end entryway to Billings, the Montana Department of Transportation eschewed traditional signalized intersections in favor of something a little rounder.

Montana's Roundabout Corridor

by Alan Woodmansey and Kirk Spalding

A series of eight roundabouts, shown here from above, improve the safety and mobility of a busy street on the outskirts of Billings, MT. *Photo: Larry Mayer for Sanderson Stewart.*

As municipalities expand into rural areas of the country, transportation systems can become strained. In Billings, MT, for example, where the population is approximately 104,000, this was the case along a 4.5-mile (7.2-kilometer) stretch of Shiloh Road. The narrow section of two-lane road was becoming increasingly congested with traffic as the city grew westward into farmlands.

In 2002, the Montana Department of Transportation (MDT) and the Federal Highway Administration (FHWA) initiated an environmental assessment to explore options for improving Shiloh Road. Although the current corridor's traffic volume is less than 13,000 vehicles per day, MDT projects that it will approach 40,000 vehicles per day by 2027. Some of the cross streets also carry as much traffic as Shiloh Road.

Based on this traffic projection, MDT and the local agencies proposed widening the existing two-lane road to a four-lane divided highway as one option. However, community members expressed concerns regarding this solution, citing a need to create an identity and a corridor that was inviting and safer for all road users. In fact, balancing safety and mobility was a key consideration for developing a solution for the area's congestion.

During the time when MDT was developing the environmental assessment, FHWA had begun promoting roundabouts as an alternative solution for intersection design. Roundabouts potentially can reduce injury and total crash rates, facilitate higher capacity, and reduce delays compared to traditional signalized intersections. Therefore, MDT and FHWA proposed considering roundabouts in addition to signalized intersections for Shiloh Road.

As a result, the environmental assessment compared multilane roundabouts to traffic signals at eight intersections. The analysis determined that a corridor of eight roundabouts would offer a better level of service than would signalized intersections. In addition, the roundabouts would cut travel times, reduce crash and severity rates, enhance capacity, and limit the need for property acquisition. The roundabout option also would address access control and other community objectives more effectively and be less expensive overall than the entirely signalized alternative.

Demonstration Of Roundabouts

Although roundabouts looked promising from the engineering perspective, some area residents and members of the project's community advisory committee were dubious about installing multilane roundabouts. That is, they were unconvinced until MDT, in cooperation with Yellowstone County and the City of Billings, hosted a roundabout demonstration. Held in a large, empty parking lot in Billings, the demonstration involved passenger vehicles, large trucks, and several firetrucks completing various intersection movements for the first time in a full-scale multilane roundabout. Residents, local media, local officials, and MDT personnel attended to observe how roundabouts work.

The demonstration roundabout, which was laid out using traffic cones in a large parking lot, gave the advisory committee members and the broader community, via television news broadcasts and local newspaper articles, something tangible to look at, walk through, and ask questions about. Videos on roundabouts from other States and communities supplemented the live demonstration to show how multilane roundabouts look and function in the real world.

"This demonstration relieved the concerns of commercial stakeholders who use Shiloh Road on a regular basis," says Vern Heisler, P.E.,

This aerial photo shows the geometry of the roundabout at Shiloh Road and Grand Avenue. *Photo: Larry Mayer for Sanderson Stewart.*

Sidewalks like this one alongside the approach to one of the roundabouts accommodate pedestrian movement in the renovated corridor, while landscaping helps provide way-finding for the visually impaired, enforces the curvatures located at the roundabout, and makes the area more visually appealing for all road users. *Photo: Kirk Spalding, Sanderson Stewart.*

deputy public works director at the City of Billings. "I was able to drive through the roundabout demonstration model to understand how the public would experience traveling through a roundabout. This experience helped me answer questions from the public regarding the roundabouts that were going to be constructed on Shiloh Road."

Another plus from the community's perspective: Roundabouts afford landscaping opportunities and an open feel, an advantage over signalized intersections.

The Preferred Alternative

In 2007, FHWA issued a Finding of No Significant Impact for the environmental assessment's preferred alternative, which included a series of eight multilane roundabouts. Although MDT had identified funding for only a portion of the estimated $40 million cost, the project was a priority for the State and the local community, so final design began on an accelerated pace.

Once the project design began, MDT held regular stakeholder meetings to keep officials and the public informed of its status. Due to the uncertainty of future funding, a decision from these meetings was to split the design into separate construction projects so the corridor could be built in three segments as funding became available.

In accordance with the locally approved plan for pedestrian and bicycling trails, the project also includes a 10-foot (3-meter)-wide asphalt multiuse path along one side of the corridor. The engineering firm included in the design at-grade pedestrian refuge areas in the roundabouts' splitter islands at pedestrian crossings, as well as one midblock crossing that featured a pedestrian-actuated warning system, a rectangular rapid flash beacon.

An unanticipated benefit of involving the public throughout the environmental assessment and design process was that a large landowner along the corridor decided to fund most of the costs for an unplanned pedestrian tunnel beneath a section of Shiloh Road. The tunnel connects the landowner's undeveloped property on both sides of the road as well as the corridor's multiuse path and sidewalk.

Since MDT had no prior experience with multilane roundabouts, the department asked its prime consultant, a design engineering firm, to retain another firm with extensive roundabout experience to complete a peer review when the design was approximately 30 percent complete. The peer review reassured the State that the design was on the right track, and only minor modifications were necessary.

The Design Takes Shape

The largest roundabout in the Shiloh Road corridor is at King Avenue, which has a 221-foot (67.5-meter) diameter and two entering and exiting lanes on all four approaches. The engineering firm designed this roundabout in such a way that it easily could be expanded to three lanes on the Shiloh Road approaches if growth expectations are met.

Large trucks are common on the road corridor. The roundabout designs accommodate WB-67 trucks—those interstate semitrailers with a 67-foot (20-meter) wheelbase commonly used to deliver goods to businesses—traveling through the roundabouts alongside passenger vehicles. Most of the roundabouts have two entering lanes with gore striping (striped area between two travel lanes of the same direction), which separates the adjacent lanes by as much as 10 feet (3 meters) and provides for the large, sweeping turning movement of the WB-67 trucks without infringing on the adjacent entry lane. This design feature also helps achieve the desired entry speed, which is less than 20 miles per hour, mi/h (32 kilometers per hour, km/h). The road surface in the roundabouts is asphalt, but the interior truck aprons (for rear axles of truck trailers to off-track) are raised, stamped red concrete.

Recovery Act Funding

By early 2009, when MDT advertised the first segment for construction, the agency had secured funding for only one segment of the corridor. When the U.S. Congress passed the American Recovery and Reinvestment Act (the Recovery Act), and the President signed it in 2009, MDT allocated Recovery Act funding to the project's remaining two segments. In fact, the first Recovery Act project MDT advertised for bidding was within the Shiloh Road corridor. All three construction projects

for the corridor thus were awarded within a 7-month timeframe in 2009.

Recovery Act funds provided almost $15 million for construction of the final two segments, which enabled MDT to complete the project years ahead of the original timeline. Plus, the contractors bid the two Recovery Act projects for 11 percent less than the engineer's estimate, which equated to $1.7 million in savings. The entire corridor was fully opened to traffic in the fall of 2010.

"The Recovery Act helped bridge a funding gap, allowing for the Shiloh Road projects to be let to contract in two construction seasons rather than the many years it would have taken utilizing traditional funding sources," says MDT District 5 Administrator Stefan Streeter.

Early Signs of Success

In June and July 2011, the prime engineering firm that designed the project conducted preliminary post-construction studies of the corridor to assess the effectiveness of the new roundabouts. The results are promising. The posted speed limit for most of the corridor is 45 mi/h (72 km/h), with advisory speeds of 15 mi/h (24 km/h) signed for the roundabouts. The engineering firm recorded the average speed for the corridor to be 37 mi/h (60 km/h) with a stop delay of less than 5 seconds. Travel time to traverse the 4.5-mile (7.2-kilometer) corridor averages 7 minutes and 20 seconds, with a variation of only 10 seconds regardless of time of day.

The longest observed queue was eight vehicles. Although observed queues were rare, those that did occur continued to move forward releasing the queue in platoons or individually as gaps in circulating traffic occurred. Prior to the reconstruction, motorists experienced significant congestion and delay during peak periods of the day at several of the major intersections, and the travel time could easily exceed 15 minutes to traverse the corridor.

Overall, MDT officials report that the as-constructed traffic conditions at the roundabouts are generally meeting expectations with few exceptions, and travel times are better than expected. "The Shiloh Road corridor is a beautiful gateway for the City of Billings," says Streeter, "allowing virtually unimpeded travel from Zoo Drive to Rimrock Road."

Alan Woodmansey, P.E., is an operations engineer in the FHWA Montana Division Office. Woodmansey was the Federal oversight project manager for the Shiloh Road project. He has a B.S. in engineering from the United States Military Academy and an M.S. in engineering management from the Missouri University of Science and Technology.

Kirk Spalding, P.E., is an associate principal with Sanderson Stewart, an engineering consulting firm headquartered in Billings, MT. Spalding served as the project manager and lead designer for the Shiloh Road project. He holds a B.S. in civil engineering from Montana State University and is a licensed P.E. in Colorado, Idaho, Montana, and South Dakota.

For more information, please contact Alan Woodmansey at 406-441-3916 or alan.woodmansey@dot.gov, or Kirk Spalding at 406-656-5255 or kspalding@sandersonstewart.com.

Gore striping helps separate the two travel lanes and provides additional space for large trucks as they pass through the roundabout at Shiloh Road and Hesper Road. Painted arrow markings on the pavement in the two travel lanes instruct motorists on how to move through the roundabout. *Photo: Kirk Spalding, Sanderson Stewart.*

Spotlight on Pedestrian Safety

by Tamara Redmon, Dan Gelinne, Leah Walton, and Jeff Miller

FHWA's aggressive approach to reducing the fatality rate in 13 States and 5 municipalities is showing promising results.

For the past 7.5 years, the Federal Highway Administration (FHWA) has been trying to aggressively reduce pedestrian deaths by focusing extra resources on the States and cities with the highest numbers or rates of pedestrian fatalities. In recent years, 13 States experienced pedestrian fatalities above 150 per year and above the national rate of 2.5 per 100,000 population. In 2003 those States were Arizona, California, Florida, Georgia, Hawaii,

Focus cities have installed high-visibility crosswalks, such as this one in Montclair, NJ, in a number of locations to improve pedestrian safety. *Photo: Tiffany Robinson.*

Before: This community center (right) is located on the north side of Van Buren Street, a busy Phoenix arterial. A large mobile home park, home to a number of children, is on the south side of the street.

Kerry Wilcoxon, City of Phoenix

After: This multistage crossing (below) resulted from a recommendation that came out of a Designing for Pedestrian Safety course. A Phoenix city crew moved the crosswalk from a nearby intersection to a midblock location that avoided some busy driveways and provided more direct access between the mobile home park and the community center.

Kerry Wilcoxon, City of Phoenix

Illinois, Michigan, New Jersey, New Mexico, New York, North Carolina, Pennsylvania, and Texas. An increase in Nevada's rate later added it to the list, while Michigan dropped off in 2007. In addition, five cities had the highest number of fatalities per year: Chicago, IL; Detroit, MI; Los Angeles, CA; New York, NY; and Phoenix, AZ. Washington, DC, later went on the list, and Detroit dropped off (only to rejoin in 2011).

To address this challenge, FHWA's Focused Approach to Pedestrian Safety project began with a memorandum dated May 2004 outlining the goal of reducing pedestrian fatalities by 10 percent by the year 2008 (goal later changed to 2011).

To address this performance goal, FHWA encouraged the affected States and cities to develop and implement pedestrian safety action plans. A previous article in PUBLIC ROADS documented the early implementation of the Focused Approach to Pedestrian Safety (see "In Step With Safety" in the September/October 2006 issue).

"The focused approach to pedestrian safety has changed the way road owners and operators view pedestrians," says Elizabeth Alicandri, FHWA director of the Office of Safety Programs. "One of the reasons it has been so effective is we identified a need—in some cases lack of knowledge of how to safely accommodate pedestrians in the roadway environment and in other cases how a public agency can transition from technical knowledge to implementation—and provided targeted training and technical assistance to those who can really make a difference."

Laying the Groundwork For Action Plans

For some States and localities, the development of pedestrian safety action plans is a new task, and existing staff often lack experience in developing and implementing the plans. Accordingly, FHWA planned to fill that gap by creating a document that helps State and local officials know where to begin addressing pedestrian safety issues: *How to*

Develop a Pedestrian Safety Action Plan (FHWA-SA-05-12). The agency completed the guide in 2006, and the National Highway Traffic Safety Administration (NHTSA) updated it in 2009 to include sections on law enforcement and education.

In addition, FHWA began offering free technical assistance and training to each of the focus States and cities, including bimonthly webinars on subjects of interest. More information about the content of those courses (Pedestrian Safety Action Plan Workshop, Designing for Pedestrian Safety, Planning and Designing for Pedestrian Safety, and How to Develop a Pedestrian Safety Action Plan) is available on the Pedestrian and Bicycle Information Center (PBIC) Web site at www.walkinginfo.org/training/pbic.

First Case Study: Arizona

Several success stories resulted from the Focused Approach to Pedestrian Safety. Three that are detailed here illustrate the program's progress to date. The first is Arizona.

In 2005, Arizona ranked fifth in the Nation with a pedestrian fatality rate of 2.64 per 100,000 population. This status led to FHWA identifying it as a pedestrian safety focus State. In response to growing concern, the State received some of FHWA's first technical assistance courses and developed a timeline for producing and implementing an action plan.

One year later, the State hosted Designing for Pedestrian Safety courses in Phoenix and Flagstaff. Following these courses, the Arizona Department of Transportation (ADOT) developed *A Guide to Developing a Pedestrian Safety Action Plan*, an Arizona-specific supplement to *How to Develop a Pedestrian Safety Action Plan*. The supplement linked the national guide's recommendations with specific opportunities for implementation across the State and set a timeline for the development of a statewide action plan.

In June 2009, ADOT released the *Pedestrian Safety Action Plan: Final Report*. Setting a goal of reducing all pedestrian crashes by 20 percent by 2016, the plan identifies priority areas and recommendations for addressing those concerns. Some of the emphasis areas include reducing crashes in high-volume urban areas, incidents involving turning vehicles, and dart-out crashes at midblock locations. The agency prioritized locations using an index consisting of pedestrian demand safety, crash severity, and stakeholder input. Next, it matched the index with specific countermeasures, including pedestrian countdown signals, improved lighting, raised medians, and crosswalk striping. Finally, the plan includes specific policy and program recommendations to improve pedestrian safety, as well as agency partnerships that will work toward accomplishing the goals.

"The FHWA publication entitled *How to Develop a Pedestrian Safety Action Plan* and corresponding training in Arizona provided insight into the opportunities for statewide pedestrian safety improvements as well as the strategies and contents of an effective action plan," says Kohinoor Kar, transportation safety engineer at ADOT. "Based on the action plan's recommendations, ADOT performed additional evaluations on high-priority locations and developed safety projects with Federal funding [for example, installing a pedestrian hybrid beacon and enhancing roadway lighting on State Route 95 in Bullhead City, AZ]. Phoenix, one of the pedestrian focus cities, developed its own action plan and generated several projects to improve pedestrian safety as well."

NYCDOT

New York City has been proactive about reclaiming space for pedestrians and creating a safe infrastructure for them, as seen here in Madison Square.

Second Case Study: Pinellas County, Florida

Between 2002 and 2007, Florida experienced the second highest average pedestrian crash rate per capita in the Nation, averaging 2.99 fatalities per 100,000 persons, exceeded only by New Mexico. Comparable to this statewide rate was the crash rate in Pinellas County, which includes the communities of Clearwater and St. Petersburg.

In September 2008, stakeholders in Pinellas County attended one of the first Pedestrian Safety Action Plan workshops. The workshop's conveners, FHWA pedestrian safety experts, used a template, based on the national guide, to help participating engineers, planners, law enforcement professionals, and other stakeholders develop a comprehensive plan for addressing pedestrian safety within Pinellas County.

After the workshop, the stakeholders collaborated with local consultants to develop the completed template into a final action plan, released in August 2009. The plan set a goal of reducing the county's crash rate from more than 13 to fewer than 10 severe crashes (defined as those resulting in a fatality or incapacitating injury to the pedestrian) per 100,000 people by 2020. Other goals include improving the transportation infrastructure to better accommodate pedestrians, changing the culture of pedestrians and motorists to encourage mutual respect, reducing real and perceived conflicts, and coordinating all activities with the support of local leaders. For each of these goals, the plan set specific objectives to improve safety using a four "E" approach: engineering, enforcement, education, and emergency medical services. Action items were included within each objective to help ensure that the plan would be realistic and achievable.

Pinellas County and the Florida Department of Transportation (FDOT) invested more than $4 million in Federal, State, and local funds for numerous countywide pedestrian safety efforts, including countdown signals, high-visibility crosswalks, pedestrian and school safety audits, a midblock crossing study and improvements, a multimedia educational campaign, and a pedestrian law enforcement program. Support from area businesses and the public school system offered additional educational opportunities countywide, which were further reinforced through school resource officers, crossing guards, and community-supported events such as a jazz festival in Clearwater and an International Walk to School Day.

In addition, a cooperative effort between FDOT and FHWA resulted in the creation of an innovative and award-winning Design-Build Push Button (DBPB) contract to use Federal funds to address safety engineering improvements promptly. A DBPB contract is set up to streamline the process of installing certain types of engineering improvements more efficiently, such as signalization, median modifications, pavement markings, signing, and similar projects that typically do not require right-of-way restrictions. This DBPB contract has proven effective in reducing the work time for safety-related construction from the typical 3 years (under traditional design-bid-build contracts) to less than 9 months.

According to Peter J. Yauch, public works and transportation director in Pinellas County, "Per the latest traffic fatality data collected by FDOT, the number of pedestrian fatalities in Pinellas County has dropped annually from 2009. Pedestrian traffic fatalities in 2010 were reduced by 15 percent. For 2011, the pedestrian traffic fatalities are estimated to be reduced by another 20 percent."

Third Case Study: New York City

Between 2005 and 2009, pedestrians accounted for 52 percent of all traffic deaths in New York City. The city's identification as an FHWA focus city reinforced local agency goals to address the issue of pedestrian safety and create safe, walkable environments. In 2010, the city completed a comprehensive analysis of more than 7,000 pedestrian crashes to better understand its pedestrian safety issues.

In August 2010, the city released the results of that analysis with a detailed action plan. Among the findings, the *New York City Pedestrian Safety Study and Action Plan* reported that common problems include motorists failing to yield to pedestrians, motorist inattention while driving, high concentrations of crashes on major corridors, and speed. To respond to these concerns, the plan includes specific recommendations for programs, policies, and countermeasures to improve safety, such as the following:

- Install more than 3,200 pedestrian countdown signals.
- Redesign streets at high-crash locations to improve pedestrian safety.
- Improve intersections to increase safety.
- Launch pilot programs to enhance senior pedestrian safety, test lower speed limits, and assess other innovative approaches.

According to Janette Sadik-Khan, New York City Department of Transportation (NYCDOT) commissioner, "[NYCDOT] aims to reduce by half [all] traffic deaths by 2030. In order to do this, the agency has collected and analyzed more data about the causes of traffic deaths and injuries and where they are happening. We are using this information to design better streets."

New York City has made a great deal of progress on its action plan to date, including redesigning 24 miles (39 kilometers) of high-crash corridors, installing countdown signals at targeted intersections, implementing neighborhood slow zones, completing implementation of left-turn safety treatments at 18 intersections, and issuing tickets to thousands of drivers for failure to yield to pedestrians and improper turns.

NYCDOT is using Section 402 funding through the Governor's Traffic Safety Committee for enforcement of high pedestrian corridors identified by the agency. In addition, NYCDOT used Section 402 funding to develop three public information campaigns: "LOOK," "Don't Be A Jerk," and "Can You See Me Now." The agency's pedestrian safety group is developing a K–12 curriculum, approved by the NYC public schools, which integrates pedestrian safety information into everyday educational curricula, such as health, environmental science, social studies, and mathematics.

NHTSA Education and Enforcement Efforts

In addition to funding a revision of *How to Develop a Pedestrian Safety Action Plan*, NHTSA provided grant funding to promote pedestrian safety education and enforcement programs in five of the focus areas: Chicago, Detroit, Florida, New Mexico, and North Carolina. In their proposals, the awardees outlined location-specific plans to implement pedestrian education and enforcement programs and strategies to complement existing or planned engineering treatments to improve infrastructure over the course of 3 to 4 years. The programs started in

Before: It was difficult to cross 4th Street (U.S. 92) safely to these dining establishments, which are across from Sunken Gardens, a popular tourist destination in St. Petersburg, FL.

Michael Frederick, City of St. Petersburg, FL

After: To aid pedestrians in crossing 4th Street, the City of St. Petersburg installed a crosswalk, pedestrian warning signage, and a raised refuge area.

Michael Frederick, City of St. Petersburg, FL

September 2009, except for Detroit, which started in 2007. The five city and State awardees based their project proposals on their active or draft pedestrian safety action plans and indicated how the grant awards would affect their ability to execute the educational and enforcement components of their plans.

Chicago. The Chicago Department of Transportation (CDOT) completed phase I of its pedestrian safety action plan, and the grant funding is assisting with implementation of phase II. CDOT completed an indepth analysis of its pedestrian crash data from 2005–2009 and, based on those data, developed a pedestrian safety education campaign directed at Chicago motorists and pedestrians. The campaign includes messages about sharing the road, avoiding distracted driving, being visible, using the crosswalk, and being aware of vulnerable road users. This information complemented an ongoing campaign to educate youth and older pedestrians.

The city also supplemented its existing enforcement activities by developing a training program and increasing crosswalk enforcement, specifically at high-crash locations identified in the pedestrian data analysis. In October 2011, NHTSA administrator David L. Strickland attended a media event to wrap up the summer activities and highlight the outcomes of the combined education and enforcement programs. Administrator Strickland and CDOT noted the positive role that the Chicago Police Department played in protecting pedestrian safety and noted improvements in drivers' yielding behavior.

Detroit. Wayne State University in Detroit, MI, in cooperation with the City of Detroit, implemented various educational campaigns and enforcement operations to support the city's existing and planned pedestrian engineering treatments. The university directed the educational campaign toward schoolchildren, resulting in a 35 percent increase in safe pedestrian crossing behaviors observed at key locations. The city then implemented waves of enforcement activities during the fall (back to school) and spring (weather warming) to increase driver yielding and to reduce illegal pedestrian crossings.

In addition, due to the high level of pedestrian crashes caused by alcohol impairment, law enforcement partnered with bar owners to distribute information to bar patrons. Concurrently, the city implemented enforcement activities to help stop impaired drivers and pedestrians from injuring themselves or others.

Florida. FDOT District 7 focused its efforts on Hillsborough, Pinellas, and Pasco counties (see related case study on page 14) to reduce the number and severity of pedestrian crashes. Through previous funding, FDOT had developed a major educational campaign delivered through a variety of media outlets. The campaign ran concurrently with the implementation of high-visibility crosswalk striping projects.

With the NHTSA funding, FDOT assigned special law enforcement details to those crosswalks to focus on observance of pedestrian and crossing laws by both motorists and pedestrians. Agency researchers collected data to determine the combined effect of the education, infrastructure, and enforcement campaign. The final results are not yet available.

New Mexico. The New Mexico DOT used its NHTSA grant funds to develop a statewide media campaign, "Look for Me," to educate high-risk pedestrians (males aged 40–44 and over the age of 64) and motorists. The campaign concentrated on the five cities with the highest incidence of pedestrian crashes. For maximum effectiveness, in conjunction with the educational campaign, the State also implemented enforcement operations at targeted intersections and crosswalks, and focused on reducing speeding in school zones and on neighborhood streets and rural roadways. The enforcement campaign started in October 2011 and will be evaluated to determine whether there were measureable changes in yielding behavior and citations.

North Carolina. The University of North Carolina Highway Safety Research Center (HSRC) began working closely with the North Carolina Department of Transportation (NCDOT) to implement educational and enforcement projects in the cities of Durham and Raleigh. The two cities have over-representation of African-American pedestrians involved in crashes. Many high-crash zones are in close proximity to high-use bus stops. The HSRC/NCDOT partnership will implement a multi-city pedestrian safety campaign in coordination with the regional transit services. Law enforcement efforts also will be conducted in areas with a history of transit use and pedestrian crashes. The efforts will aim to encourage motorists to yield to pedestrians at crossings and educate pedestrians on safe walking practices, particularly around transit stops. This effort is part of a broader NHTSA project that began in 2009 to examine pedestrian crashes and implement pedestrian safety programs in several North Carolina cities.

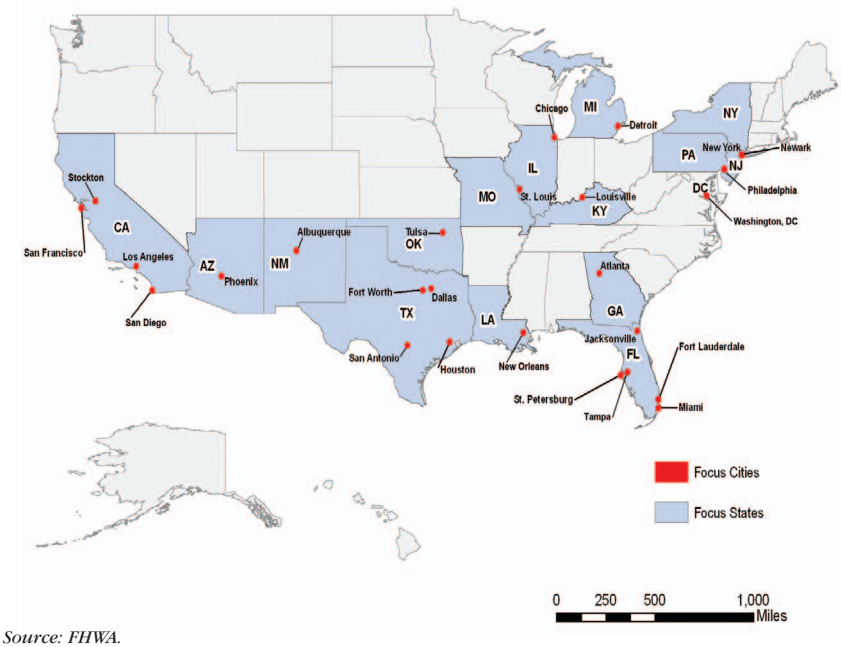
Evaluating the Focused Approach

To determine the effectiveness of the Focused Approach to Pedestrian Safety, FHWA has completed two evaluations. In 2009, Volpe National Transportation Systems Center completed an initial evaluation. Overall, the evaluation was positive and documented the changes that have come about in the focus States and cities as a result of the technical assistance provided in recent years. Changes include instituting new policies to improve conditions for pedestrians, equipping engineers and planners with information they can use to accommodate pedestrians and improve safety, and implementing engineering improvements at some of the locations recommended by participants in the pedestrian safety courses.

The study also found the following:

- The focused approach showed overall positive results with far-reaching consequences, such as raising the visibility of pedestrian safety in focus locations, drawing attention to and generating momentum and resources for addressing pedestrian safety issues, improving participants' understanding of and attitudes toward pedestrian safety issues, increasing the ability of participants to advocate for pedestrian safety improvements, and providing them with practical tools and techniques for assessing and solving pedestrian safety problems.
- Designation as a focus State helped raise awareness and added legitimacy to pedestrian safety approaches not previously employed.
- The focused approach spurred changes in policies focused on pedestrian safety, such as California promoting the development of pedestrian safety action plans by local governments through the State, business processes such as Chicago's pedestrian safety staff working with the police department to improve the consistency and comprehensiveness of data collected at crash scenes, and institutional structures such as Chicago

Current FHWA Pedestrian Safety Focus States and Cities



Source: FHWA.

forming a multidisciplinary Mayor's Pedestrian Advisory Council that includes a pediatrician who specializes in traumatic injuries and fatalities in children.
- Prior to participation in the program, some focus States had not used any targeted safety funding to address pedestrian safety. The focused approach helped draw attention to pedestrian safety and led to applying resources to pedestrian safety efforts.

A more comprehensive evaluation conducted in 2010 included a look at all of the FHWA focus areas and turned up additional encouraging results. In the States that had not been designated as pedestrian focus States, pedestrian fatalities between 2002 and 2008 decreased 4.7 percent and the overall fatality rate decreased 11.2 percent. During that same period, the fatalities decreased 12.1 percent, and the fatality rate decreased by 21.8 percent in the pedestrian focus States—more than double. Although those declines cannot be attributed solely to FHWA's efforts in the focus States and cities, the agency believes that the $1 million total expenditure of contract money over the 6-year period was a sound investment.

In fiscal years 2010 and 2011, FHWA conducted a comprehensive evaluation of all bicycle and pedestrian safety activities. Although FHWA's evaluation of the Focused Approach to Pedestrian Safety found it to be an effective method for directing safety efforts toward a specific group of States, the evaluation of all pedestrian and bicycle safety activities recommended a change in the way pedestrian services and information are delivered.

The independent evaluation, conducted by Booz Allen Hamilton, recommended that FHWA work with its Federal partners to combine their safety-oriented resources and messages with design-, planning-, and operationally oriented resources to give State and local planners a more comprehensive look at all bicycle-pedestrian issues. The evaluation also confirmed that pedestrian and bicycle safety measures could be more successful if FHWA focused on expanding its range of services beyond safety planning to include assisting States in building more proactive and comprehensive pedestrian and bicycle safety programs. These suggestions, among others, will be a consistent priority for FHWA in the future.

Moving forward, FHWA also will be making a few changes to the Focused Approach to Safety. Both FHWA's and the independent evaluation found that pedestrian safety is more of an urban-local problem, often led through local efforts. So the agency has retooled the focused approach to concentrate on focus cities (rather than States). FHWA has identified cities that can benefit the most from being involved in the focused approach and will work with their State or local transportation agencies to deliver technical assistance, training, and other tools that can help drive a faster reduction in pedestrian fatalities.

A few of the current focus States will move off the list, and a few new ones will be added. Each State that has one or more focus cities will be invited to be a focus State. On September 27, 2011, FHWA announced 16 pedestrian focus States that represent the following 26 focus cities: Phoenix, Los Angeles, San Diego, San Francisco, Stockton, Ft. Lauderdale, Tampa, Miami, St. Petersburg, Jacksonville, Atlanta, Chicago, Louisville, New Orleans, Detroit, St. Louis, Newark, Albuquerque, New York City, Tulsa, Philadelphia, Houston, Dallas, San Antonio, Fort Worth, and the District of Columbia. Information on the Focused Approach to Safety and eligible States can be found at http://safety.fhwa.dot.gov/fas.

"We will continue with the pedestrian safety focused approach as we move forward and expect to be even more successful with our revised emphasis on pedestrian focus cities," says FHWA's Alicandri. "As we move into a more performance management-based system, we will emphasize the need for evaluating baseline performance in each focus location to measure progress more accurately."

According to Gabe Rousseau, FHWA bicycle and pedestrian program manager and livability team leader, "It's important to ensure that we make all transportation modes, including walking, safer and more convenient. If people avoid walking because of unsafe roadway conditions or won't let their children walk to school, then we have important safety problems that need to be addressed, too."

Tamara Redmon is the pedestrian safety program manager for FHWA's Office of Safety. She has worked for FHWA for more than 20 years and in her present position develops products and programs to help reduce pedestrian crashes, fatalities, and injuries. She holds a B.A. degree from Virginia Polytechnic Institute and State University and an M.A. from Marymount University.

Daniel Gelinne is a project coordinator at UNC HSRC and program manager for PBIC. He received his B.A. in geography and environmental science from the University of North Carolina at Chapel Hill.

Leah Walton is a highway safety specialist at NHTSA, where she has been since 2006. Walton serves as the agency expert on pedestrian safety programs and serves on the NHTSA Youth Traffic Safety Team. Prior to her employment with NHTSA, she worked on underage drinking programs for Mothers Against Drunk Driving at the national and State levels. She holds a B.A. from Hamline University.

Jeff Miller serves as team leader for analysis and evaluation in FHWA's Office of Safety. His team is responsible for analytical processes and tools for safety decisionmaking, data analysis, the focused approach, and program evaluation. Before joining FHWA in 2009, he worked for the Federal Motor Carrier Safety Administration, the United States Capitol Police, and the Federal Emergency Management Agency. He holds a B.A. in political science from Bridgewater College and earned an M.A. in government from Johns Hopkins University in December 2011.

For more information, contact Tamara Redmon at 202-366-4077 or tamara.redmon@dot.gov, Dan Gelinne at 919-962-8703 or gelinne@hsrc.unc.edu, Leah Walton at 202-366-4969 or leah.walton @dot.gov, or Jeff Miller at 202-366-0744 or jeffrey.miller@dot.gov.

Why Does FHWA Have a Chemistry Lab?

These FHWA researchers are at work in the agency's new state-of-the-art chemistry laboratory in McLean, VA.

A state-of-the-art renovation in 2011 increased the laboratory's utility and effectiveness. Find out how the laboratory can work for you.

by Terry Arnold and Gretchen Stoeltje

On the face of it, paving a highway with hot-mix asphalt is a straightforward process. In reality, it is very complex. Many decisions, based on a number of variables, need to be made at every stage of the process—from selecting the raw materials, proper blending of the aggregate sizes, and laying the pavement itself to create a sound structure. At any stage, something can go wrong that may not be manifested until long after the pavement is in service, possibly resulting in a drastically shortened service life. Extensive repairs or replacement of pavements can be extremely costly.

The focus of the Pavement Materials Team in the Federal Highway Administration's (FHWA) Office of Infrastructure Research & Development is to evaluate pavement and materials to optimize their use, extend pavement life, and reduce costs. The chemistry laboratory

at FHWA's Turner-Fairbank Highway Research Center (TFHRC) in McLean, VA, is part of that effort. One of the lab's key objectives is to provide Federal researchers, State agencies, and industry partners with a forensic toolbox to assist them with controlling the quality of materials and investigating premature failures. In addition, the TFHRC research facility sometimes evaluates commercial materials that are widely used in the paving industry as part of a research study to determine their potential efficacy and longevity in pavement structures.

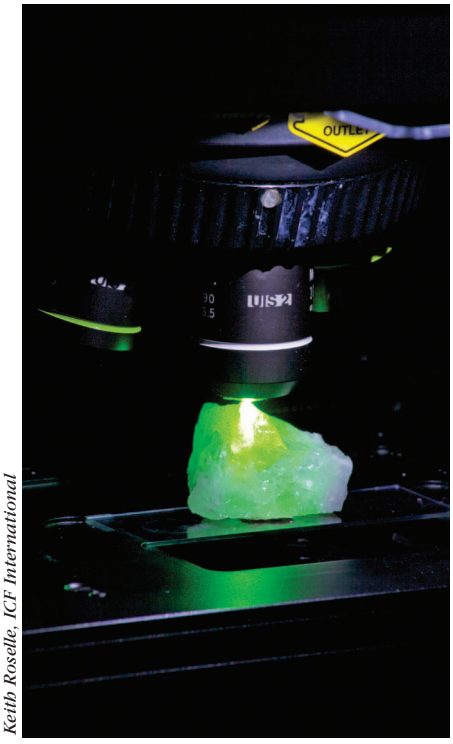
A chemistry laboratory has existed within the Federal highway system for more than 100 years. Prevost Hubbard was chief of the Physical and Chemical Labs, Bureau of Public Roads, U.S. Department of Agriculture from 1905–1919. The laboratory moved to its present location in 1950. In 2011 the lab underwent a major renovation to make it a state-of-the-art facility for research. Today, it is housed in three rooms: One consists of a wet chemistry laboratory, the second contains various chemical and spectroscopic instruments, and the third houses a scanning electron microscope.

"Fundamental challenges we need to address with regard to engineering problems are related to the chemistry of the component materials and their interactions," says Jorge E. Pagán-Ortiz, director of FHWA's Office of Infrastructure Research and Development. "To enable us to resolve these complex challenges we need a sophisticated and well-equipped chemistry laboratory."

Chemistry: The Molecular Perspective

Traditionally, some people think of chemistry labs as dark, smelly places containing lots of glassware. Strange liquids bubbling away, producing ominous odors. This is traditional "wet chemistry" where many analyses and chemical reactions are carried out with liquids in glass flasks. Typically, these analyses and reactions involved processes like distillation, titration, filtration, and chemical reactions. These types of chemistry laboratories still exist, including one at FHWA where the staff does sample preparation.

The world has changed. Chemistry has changed with it. Analyses that used to take hours or days now can be completed in minutes with the aid of new electronic analysis equipment. The main instrumentation lab at FHWA clearly shows the difference. This room houses most of the electronic analysis equipment. Another room houses a powerful scanning electron microscope that enables the staff to visually examine samples of aggregate, concrete, and other materials in great detail.



Keith Roselle, ICF International

This instrument is measuring the Raman spectrum of a sample of quartz.

Paving and bridge engineers concern themselves mostly with the bulk physical properties of materials. Yet, steel and concrete, like everything else, are composed of atoms and molecules. It is the bonding between these atoms and molecules that give strength to structures like bridges. If engineers know more of what is happening at the atomic and molecular levels, they are in a better position to judge the condition of a bridge or pavement.

Atoms and molecules are extremely small. For example, a piece 0.66 inch by 0.66 in. (17 millimeters, mm, by 17 mm) of 1-in. (25.4-mm)-thick steel gusset plate would contain 6.0221415×10^{23} atoms of iron (Avogadro's number). This is such a huge number that it is difficult to conceive just how large. Bill Bryson provides an interesting way to comprehend this number in his book, *A Short History of Nearly Everything*: If the atoms in that small sample of gusset plate were the size of popcorn kernels, they would cover the entire United States to a depth of 9 miles (15 kilometers).

While atoms and molecules cannot be seen with the naked eye, they can be excited in various ways using heat, light, or x-rays, for example, and their responses to those stimuli can be measured. From this, researchers can deduce information about the chemical structures. The response generally is plotted against a variable like wavelength of light or x-ray energy. These plots are known as spectra, which are produced using machines called spectrometers. To make a spectrum easier to read, the usual practice is to show the wavelength as a wavenumber, the reciprocal of the wavelength.

FHWA researchers at the TFHRC chemistry lab have an array of rapid spectroscopic, optical, and analytical tools at their disposal that enable them to study pavement materials at the atomic and molecular levels. These techniques, along with more traditional wet chemistry methods, offer a powerful combination that FHWA researchers can use to investigate paving phenomena and assist other researchers in examining pavement structures.

By studying molecules and atoms, chemists look at things with a different perspective than engineers do. For instance, pavement contractors have used phosphoric acid for many years as a low-cost way to stiffen asphalt and help it resist rutting caused by traffic. A premature pavement failure in Nebraska, at first blamed on the use of phosphoric acid, led to unsubstantiated fears in the industry concerning phosphoric acid. The FHWA chemistry laboratory carried out a research program to investigate these concerns. Mostly, the fears had no technical merit and were unfounded.

The chemistry lab researchers learned: Yes, you can safely use phosphoric acid as an additive. No, it won't cause the asphalt to age more rapidly. Yes, you can use it with limestone aggregates. Yes, you can use it with some antistrip additives. Yes, it might lower the

moisture resistance of the pavement. Although the exact cause of the pavement failure in Nebraska is still under investigation, the lab researchers determined that the appropriate use of phosphoric acid can be suitable for modifying asphalt mixtures to improve rutting resistance and pavement life. These findings reassured some State departments of transportation (DOTs), although some still do not allow use of phosphoric acid.

During this 6-year research program, the team developed a quick and simple test method requiring no specialized knowledge or equipment that State DOTs could use to detect the presence of phosphoric acid in asphalt binders. The American Association of State Highway and Transportation Officials (AASHTO) has adopted this test: Detecting the Presence of Phosphorous in Asphalt Binder AASHTO Designation TP 78-09.

Putting Chemistry To Work

Hot-mix asphalt pavements contain approximately 95 percent aggregate and 5 percent asphalt binder, the black sticky residue left at the end of the refining process after all the fuels and oils have been removed. Its chemical composition and properties are dependent on the source of the crude oil from which it came. Many materials can be added either to the asphalt or the aggregate to improve performance and extend the life of the pavement.

When water penetrates asphalt pavements, some asphalts can lose their adhesion to the aggregate, resulting in the demise of the pavement via stripping (separation of the asphalt film from the aggregate in the presence of water). Pavement engineers can use additives to prevent this adverse condition from occurring. One approach is to treat moisture-sensitive aggregate with lime (calcium hydroxide). Since no direct test method existed for determining the presence of lime, it was impossible for DOTs to determine if an aggregate had been treated with lime.

To address this gap, the FHWA researchers at TFHRC developed a test method that is now an AASHTO provisional method. Part of the method, which answers the question of whether lime is present in the pavement, uses a technique called Fourier Transform Infrared Spectroscopy (FTIR).

How is FTIR applied to determine the presence of lime in asphalt? Well, molecules are always in motion, vibrating and flexing in different ways. When they vibrate, they absorb energy at different wavelengths of the electromagnetic spectrum. Sunglasses, for instance, absorb in the visible region. Carbon dioxide, the greenhouse gas, absorbs in the infrared region. By measuring the absorption at different wavelengths, chemists can tell a lot about the molecular structure of the material. The plot of absorption against wavelength (more commonly, wavenumber) is an FTIR spectrum, which contains a number of peaks. The positions of the peaks provide information about the kinds of chemical groups in the sample, while the area under the peaks is indicative of the amount present.

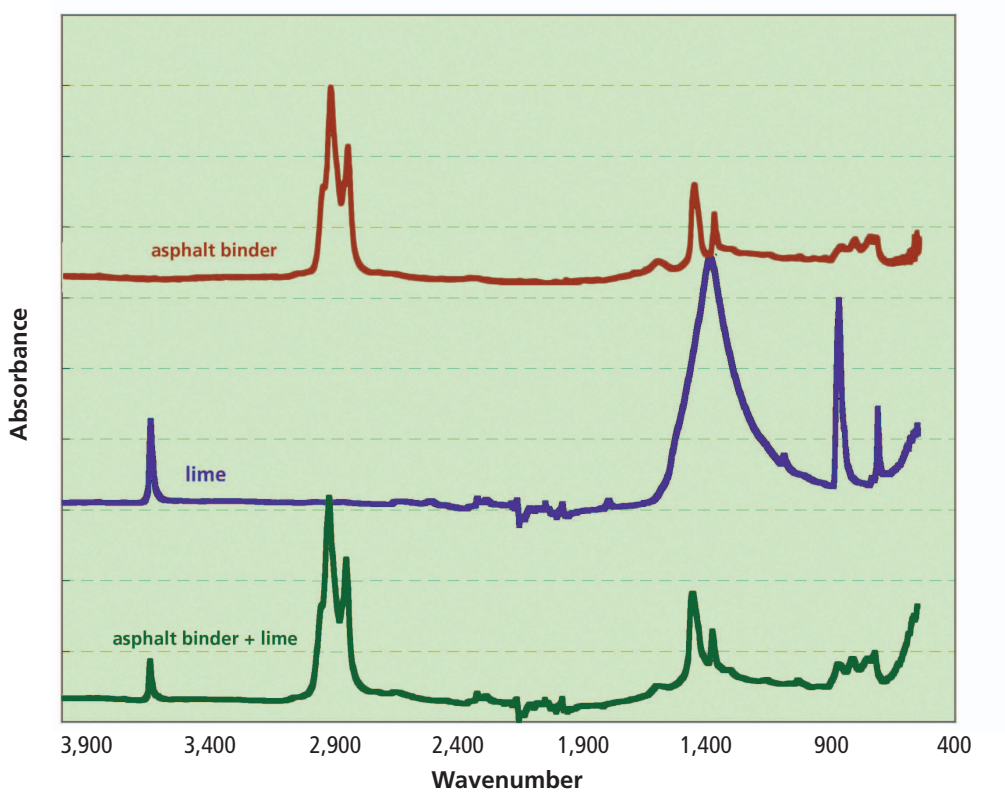
Application of the technique is simple. A small sample is placed on the diamond window of an accessory called an Attenuated Total Reflectance bridge, and the spectrum collected. The test typically takes less than a minute. Asphalt produces a very characteristic spectrum, whereas the FTIR spectrum of lime is completely different. Lime has a very sharp peak at 3,600 wavenumbers that can be used as a marker. If the asphalt contains lime, the distinctive marker is clearly visible.

The FTIR spectrum will show whether lime is present. Determining exactly how much lime is contained in the sample is more complicated, but this part of the test can be completed in a few hours. The FHWA test method is now an AASHTO provisional test method (AASHTO TP 72-08 [2010]) that the industry can use to ensure that lime has been added to the mix.

A similar approach can be applied to asphalt binders modified with polymers. To improve the damage resistance (that is, resistance to rutting and cracking) of asphalt pavements, common practice is to

Lab researcher Anant Shastry is preparing samples for the x-ray fluorescence spectrometer.

FTIR Spectra: Asphalt and Lime



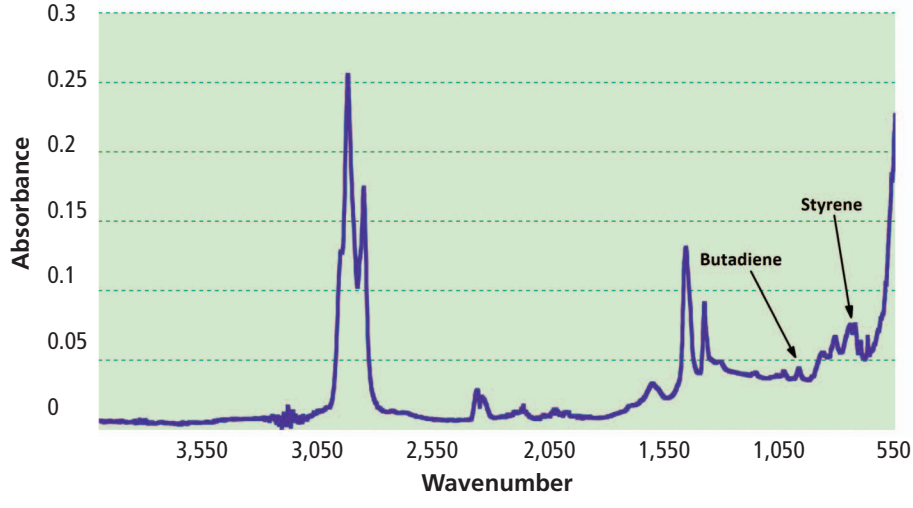
This FTIR spectra clearly demonstrates the presence of lime. *Source: FHWA.*

add polymers to the asphalt binder. These materials are expensive compared to the other components in the mix. The most common polymer used in the United States is SBS, a rubbery polymer made from styrene and butadiene. This polymer confers some elastic properties on the binder. Many State DOTs use time-consuming methods to measure the elastic properties of the binder to ensure that they are obtaining the materials for which they are paying. Determining the presence of these polymers can be achieved rapidly and simply by taking an FTIR spectrum of the material in question. Some DOTs use this method, and the FHWA researchers at TFHRC have the capability of running the test in the chemistry lab. Two peaks in the spectrum indicate the presence of the styrene and butadiene, and the size of the peaks can be used to calculate the quantities present.

A third application of FTIR spectroscopy is to monitor the aging of an asphalt binder. Asphalt is a black sticky solid that reacts slowly with oxygen in the air and oxidizes. With time, it becomes brittle and may begin to crack and fall apart. This aging is a major factor limiting the life of an asphalt pavement. Researchers study asphalt aging in order to monitor the degradation of a pavement with a view to predicting and extending pavement life. By using FTIR to measure the amount of carbonyl and sulfoxide, two of the oxidation products that contribute to the pavement's embrittlement, researchers can study the rate of aging to determine its extent or to find ways of slowing it down.

Over the years, a number of materials have been marketed as additives for asphalt binders with the promise of extending pavement life. Some of these additives can be detected using x-rays. While FTIR

FTIR Spectrum of Asphalt Binder Containing SBS Polymer



The styrene and butadiene bands in this FTIR spectrum show that the asphalt binder contains SBS polymer. *Source: FHWA.*

spectroscopy provides information about molecular environments, x-ray fluorescence spectroscopy (XRF) can provide information about the elements themselves. With XRF, samples are irradiated with x-rays, and a complete analysis of all the elements from sodium to uranium in the Periodic Table is provided in just a few minutes. FHWA initially purchased the XRF unit for the chemistry lab to analyze cement and concrete, but the team has found it useful for investigating asphalt binders as well.

Examination of the trace metals in asphalt binders recovered from pavements can provide insights into what materials have been added. These binders can be helpful in forensic investigations.

Sample AAK-1 is a reference asphalt used in the Strategic Highway Research Program. The crude oil source from which the sample was derived came from Venezuela. All crude oil contains vanadium, but this particular one from Venezuela contains an unusually high level of this element.

Sample B6286 had been modified by a special process in which rubber ground from used tires was digested into the asphalt. The high level of zinc in this asphalt came from the tire rubber.

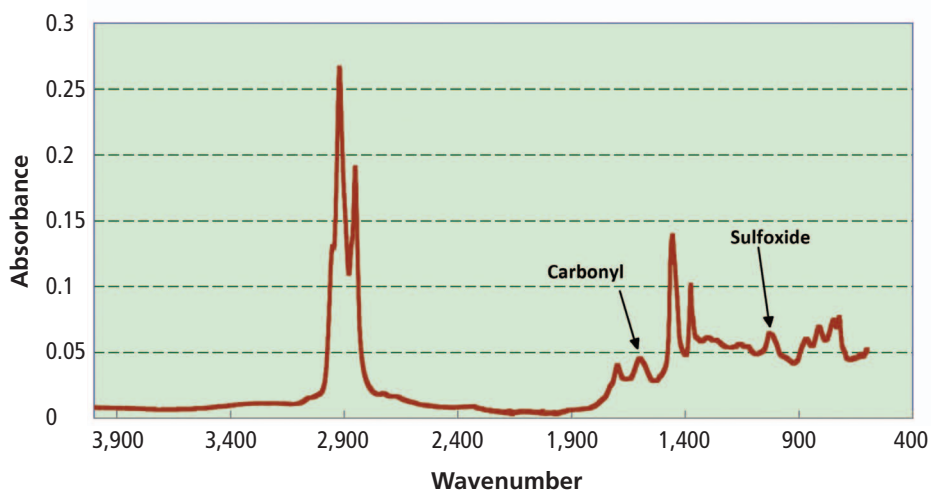
Sample B6269 also contained high levels of zinc as well as iron and copper. This too had been blended with ground tire rubber by a simple thermal shearing process used in Arizona.

Sample XRF1-75-2 was from a forensic study in cooperation with the Maine Department of Transportation. The sample had been modified with phosphoric acid.

Sample AS1-134-2, the last sample, had been modified with a residue obtained from waste engine oil. Calcium and zinc found in the sample came from additives used in the manufacture of the engine oil; iron and copper were metals worn from the engines.

Another application is illustrated by a recent forensic study in which the FHWA researchers at TFHRC were asked to help identify the root cause of a premature pavement failure in Nevada. The distress mechanism was described as top-down stripping (moisture damage) and fatigue cracking. Federal Lands personnel who submitted the request suspected that lime had been omitted from the mix and that the asphalt binder had been contaminated with heating oil or diesel fuel. By using the two techniques together (FTIR and XRF), FHWA was able to show that lime had indeed been added to the mix and that the asphalt binder had been modified with waste engine oil residues. Characterization of the cores turned up nothing out of the ordinary except that the effective asphalt film thickness was found to be below specification and was the most likely cause of failure.

FTIR Spectrum of an Aged Asphalt Binder



The presence of the carbonyl and sulfoxide peaks reveals that this is an aged asphalt binder. *Source: FHWA.*

Current Research

The FHWA chemistry lab also is involved with research into liquid antistrip additives sometimes used in asphalt binders. Liquid antistrip additives are used to improve the moisture resistance of asphalt pavements and function in a way similar to the addition of lime. The major differences are that the liquid additives containing amines or phosphate esters are added to the asphalt

XRF Elemental Analysis of Asphalt Samples

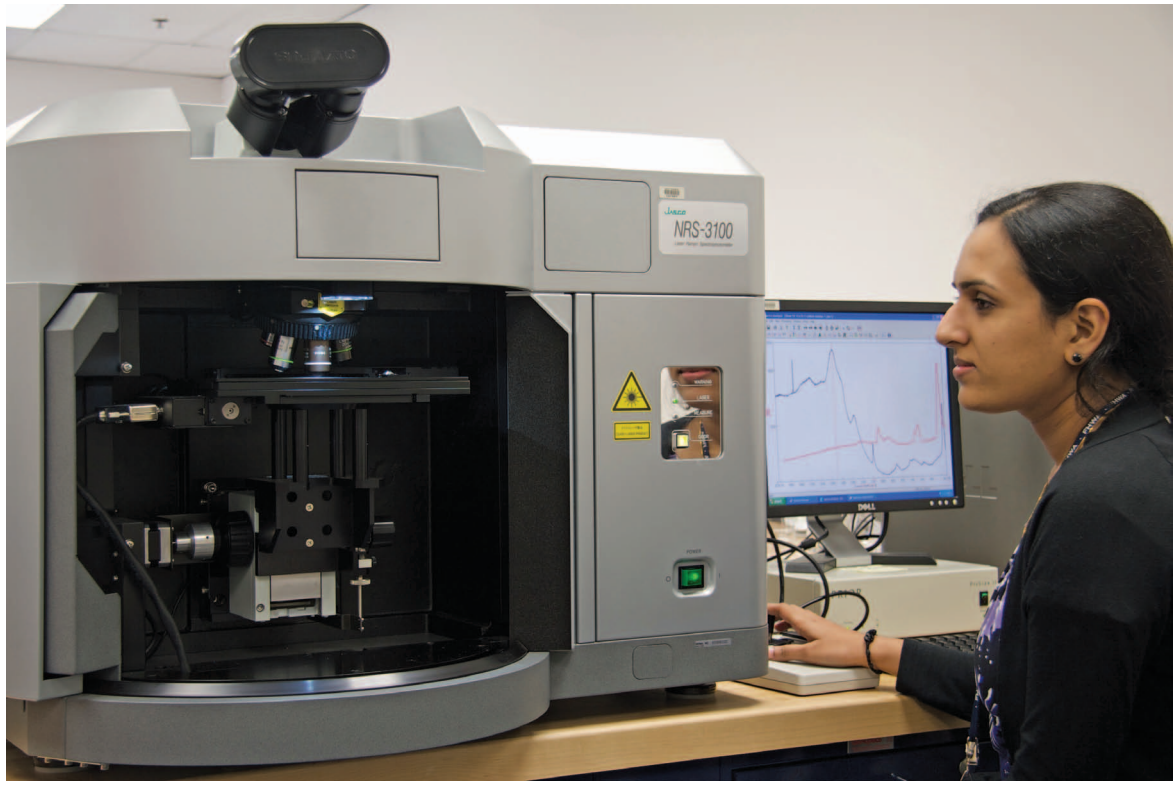
	Concentration in Parts Per Million				
Sample Reference	**AAK-1**	**B6286**	**B6269**	**XRF1-75-2**	**AS1-134-2**
Phosphorous	950	870	570	8,140	3,060
Sulfur	52,140	31,270	37,890	41,600	15,650
Calcium					2,256
Iron	13	15	164	19	284
Copper			89		447
Zinc		298	2,540		1,202
Molybdenum		16			96
Lead					
Vanadium	1,483	270	887	273	146
Nickel	154	59	115	68	81

A little crane lowers the cups containing samples into the x-ray chamber of the XRF spectrometer.

binder and not to the aggregate as is the case for lime usage. Since many liquid antistrips are available and customers have their own preferences, asphalt producers usually meter them into the truck while it is being loaded at the asphalt terminal. No method exists, however, to determine accurately whether the correct quantity of the specified material was added and ended up in the asphalt mixture. If the pavement shows signs of moisture damage early in its life, this sometimes leads to disputes between DOTs and contractors. The FHWA chemistry lab is developing a method to identify and accurately determine the quantity of liquid antistrip in asphalt binders.

Another part of the lab's current research is to find a rapid method to identify the presence of alkali-silica reaction (ASR) gels in concrete. The presence of ASR gels causes a destructive expansion that takes place in some concrete structures. No reliable field test to detect the presence of ASR gels exists. The chemistry laboratory is using a technique called Raman spectroscopy to detect the presence of ASR gels. Raman spectroscopy is a technique widely used by the FBI to investigate forgeries and by the art world to examine paintings. The sample is irradiated with a powerful laser light, which polarizes the electrons around the molecule and results in a Raman spectrum, similar to the FTIR spectrum described earlier. The reason for this research is not only to develop a field test, but also to come up with a rapid test to determine the potential of an aggregate to form ASR gels when the aggregate is used in concrete. This test would replace the mortar bar test ASTM 1260, which takes 16 days, and ASTM1293, which takes 1–2 years.

The analytical techniques discussed so far deal with atoms and molecules. The lab also can look at larger entities, namely crystals that have a uniform chemical packing. The atoms in crystals arrange themselves in a very precise way, giving the crystal a characteristic shape that depends on the material. Table salt, as an example,



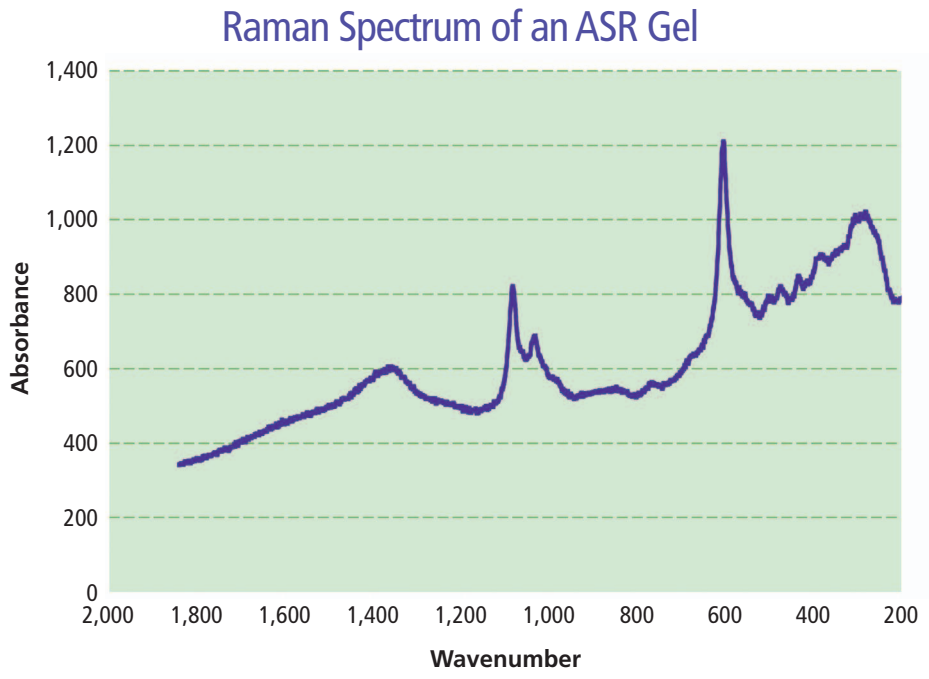
Chandni Balachandran, with the FHWA chemistry lab at TFHRC, is using the Raman spectrometer to examine a specimen of an ASR gel.

under a microscope appears as tiny cubes. Many materials exhibit characteristic crystalline structures and have the ability to diffract x-rays in characteristic patterns.

These diffraction patterns are obtained using an x-ray diffractometer. The sample is exposed to a narrow x-ray beam. The detector measures the response from the sample, and the signal strength then is plotted against the angle of the x-ray beam to the sample. The characteristics of these patterns facilitate the identification of the various crystals present in a sample, and the lab's researchers use them to study cement hydration and fly ash being used as a substitute for cement in concrete.

The manufacture of cement produces carbon dioxide, which is considered a greenhouse gas. The industry can reduce the amount of cement manufactured and the greenhouse gas emissions produced by substituting fly ash for the cement used in concrete. Fly ash is the dust collected from the stacks of coal-burning power plants. In the United States, coal plants produce more than 100 million tons (90.7 million metric tons) of fly ash per year, of which 30 million (27.2 million metric tons) are utilized, some of it to replace cement, and 70 million (63.5 million metric tons) are landfilled. The problem is that concrete made with high amounts of fly ash takes longer to set than regular concrete, although its ultimate strength might be higher. A concrete pavement usually can be opened to traffic a week or so after construction. High levels of fly ash probably could double this time.

Cement contains materials with delightful names like alite, belite, aluminate, and ferrite. When concrete is made by mixing cement with water, sand, and aggregate, chemical reactions take place and these materials change. They have a characteristic x-ray diffraction pattern that changes as new substances are formed. These changes can be measured using an x-ray diffractometer. By placing a small sample of wet cement in the machine, researchers can accurately measure the rate at which these materials form, indicating how rapidly the concrete will set. When fly ash is introduced, the reaction products and the rate at which they are formed change. Researchers can use these changes to explore ways of increasing reaction rate so that the concrete sets more rapidly and can accommodate highway traffic sooner.



The FHWA lab at TFHRC is believed to be the first to successfully identify an ASR gel using Raman spectroscopy. *Source: FHWA.*

Summary of Major Points

- FHWA has a new state-of-the-art chemistry facility that is available to assist State DOTs and industry partners in evaluating pavement materials and premature pavement failures.
- Major problems solved and accomplishments include technical information to support limited use of phosphoric acid, detection of lime, and evaluation of the characteristics of degradation through aging.
- Current research at the lab is tackling difficult challenges at the forefront of highway research, such as detecting ASR gels and reducing the highway industry's carbon footprint.

What's Next?

This snapshot of some of the chemistry lab's activities perhaps can suggest to readers how their agencies might make use of its capabilities. Though the lab's researchers use complex equipment to conduct much of their work, they have an eye toward developing simpler devices for use in the field.

Forensic investigations are far from trivial exercises. For readers who find themselves scratching their heads over tough problems, the lab's team urges them to call—and adds, "Even if you don't have a problem, come and see the lab. Visitors are always welcome!"

Terry Arnold manages the chemistry research complex at TFHRC. A native of England, he has a bachelor's degree in chemistry from the Royal Institute of Chemistry and is a fellow of the Royal Society of Chemistry.

Gretchen Stoeltje works in the Texas Department of Transportation's Office of Strategic Policy and Performance Management. She researches, writes, and makes films about transportation and its connection to other areas of public policy. She earned a bachelor's degree in film theory and a graduate certificate in film production from the University of California Santa Cruz. She earned a law degree from Santa Clara University.

For more information, contact Terry Arnold at 202-493-3305 or terry.arnold@dot.gov, or Gretchen Stoeltje at 512-416-2064 or gretchen.stoeltje@txdot.gov.

The DRT Start

by Gene McHale

FHWA's Data Resources testbed is up and running—collecting, managing, storing, and visualizing data generated by the agency's new Transportation Operations Laboratory.

(Above) Growing traffic congestion like this has focused attention on the need to develop and test new strategies to operate the Nation's roadways efficiently. To meet this need, FHWA has opened the new Saxton Transportation Operations Laboratory, which includes a Data Resources testbed. *Photo: Texas Transportation Institute.*

Congestion on U.S. roads continues to be an issue for the traveling public. According to the Texas Transportation Institute's 2011 *Urban Mobility Report*, an automobile commuter in one of the Nation's 15 largest metropolitan areas experiences 52 hours of delay on average and wastes 25 gallons of fuel, which costs the motorist $1,083 each year due to congestion. For the Chicago and Washington, DC, metropolitan areas, the numbers are over 70 hours of delay and more than 35 gallons of wasted fuel.

At its most basic, congestion can be explained through supply and demand. There is simply not enough supply, or roadway capacity, to handle the demand for travel. To those stuck in traffic, it is of little consolation that many view the high demand for travel as a sign of an active economy.

The limited roadway capacity is largely due to the high cost of building new roads or expanding the capacity of existing roads.

"Growing travel demand and limited ability to build new capacity make efficient management and operation of the Nation's roads extremely critical," says Federal Highway Administration (FHWA) Associate Administrator for Operations Jeff Lindley. "In recent years, the importance of transportation operations has grown tremendously due to increasing demands and limited resources for building new road capacity."

Practitioners in the field of transportation operations are constantly looking for new strategies and approaches to better manage roadways. As in other transportation disciplines, researchers typically conceive, analyze, and test new strategies in a laboratory environment prior to field testing and deployment. The mission of the FHWA Office of Operations Research & Development (R&D) is to envision and evaluate new transportation strategies, improve the underlying technologies that facilitate those strategies, and develop and test the new strategies in field settings. To assist in achieving that mission, FHWA has designed and implemented a new Saxton Transportation Operations Laboratory (TOL) located at the Turner-Fairbank Highway Research Center (TFHRC) in McLean, VA.

The Saxton TOL consists of three component testbeds: Concepts and Analysis, Cooperative Vehicle-Highway, and Data Resources. A testbed is an environment where new strategies and technologies can be tested and evaluated prior to real-world deployment. The Concepts and Analysis testbed focuses on identifying and developing concepts for new transportation operations strategies and evaluating their impacts using simulation and other analytical tools. (See "Modeling Transportation Systems: Past, Present, and Future," in the September/October 2011 issue of PUBLIC ROADS.)

The Cooperative Vehicle-Highway testbed takes the development of new strategies to the next level by testing prototypes in fieldlike settings using the TOL's intelligent intersection, specially equipped vehicles, and other hardware and software components. (See "A Living Outdoor Laboratory" in the November/December 2011 issue.)

The role of the Data Resources testbed includes the capture, management, storage, and visualization needs of data generated by the other two testbeds. It also serves as a data resource for the broader research community.

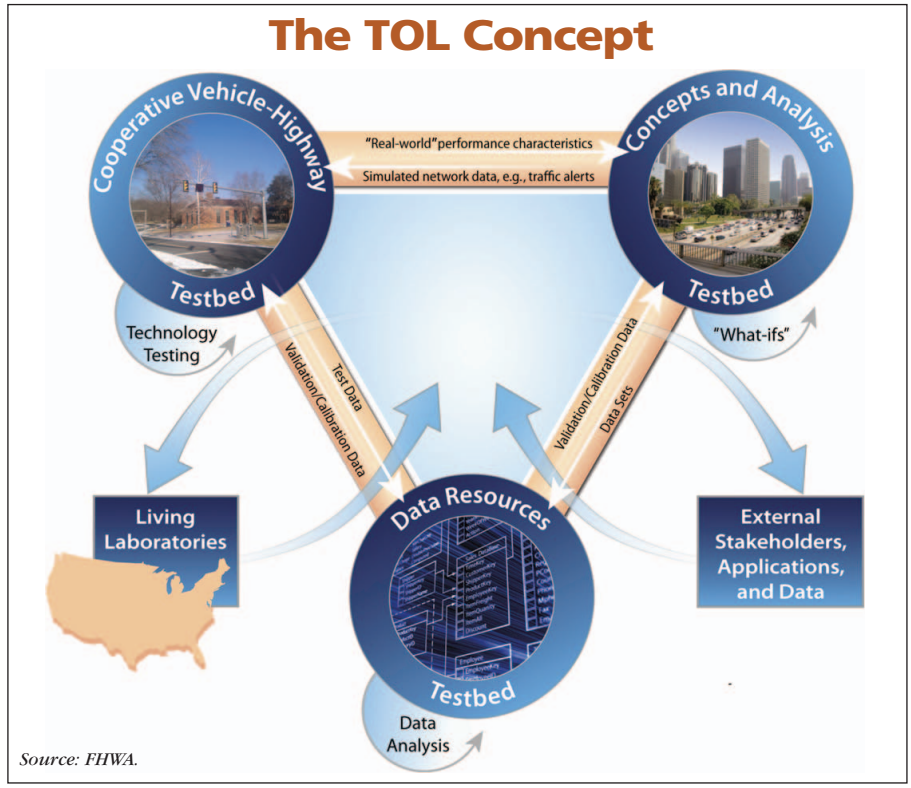
The Need

Historically, transportation data were hard to come by. Most of the detectors and other equipment for data collection deployed on U.S. roads were installed in fixed locations and served fixed needs. Examples include inductive loop detectors in the pavement at traffic-signalized intersections to detect when vehicles are waiting on side streets at red lights. Other examples include detector count stations installed on freeways to feed information for real-time traffic monitoring and use in annual reporting of highway performance.

In the early 1990s, a renewed focus on transportation operations and the introduction of new intelligent transportation systems (ITS) services with their corresponding data requirements led to an increase in the number and types of equipment for data collection. The new systems employed radar, video image processing, acoustic sensing, infrared, and wireless communications for traffic signal control, freeway operations, incident management, and electronic toll collection. With so much data being collected, however, most of it was not stored, shared, or used for purposes other than those for which it was originally intended. The transportation community and FHWA recognized the need to store useful transportation data from ITS systems and mainstreamed its response in 1999 by adding the Archived Data User Service to version 3.0 of the National ITS Architecture. The National ITS Architecture defines a set of user services and provides a common framework for State and local agencies in the planning, design, and implementation of ITS.

Today, archived data on transportation operations are fairly common. The ability to share and reuse this data, however, is still hampered by the lack of clear, consistent documentation. Good metadata, or data about data, are critical to enable reuse for purposes beyond those for which the data were originally collected.

Another characteristic of today's widely available data archives is that



Source: FHWA.

This in-pavement loop detector, indicated by the pavement cut, is typical of the sensors used to collect data on roadway use and performance. However, these detectors are limited to the extent that they provide data from only a single point location on a roadway.

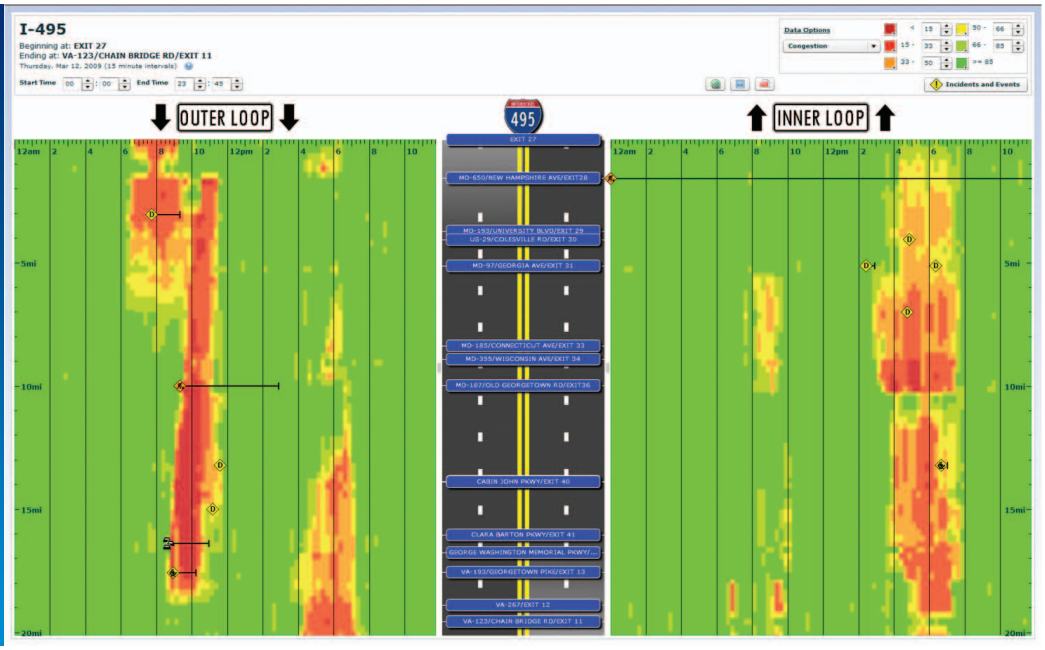
they typically represent data from a single type of source (for example, data from freeway loop detectors along specific sections of highway). What is less common are data available from a variety of sources and transportation modes, such as freeway loop data combined with traffic data on nearby arterials and data on weather conditions, incidents, transit operations, or freight movements.

Current successful examples of well-documented, integrated data include the U.S. Department of Transportation's (USDOT) Next Generation Simulation (NGSIM) program. The NGSIM program made available a number of well-documented datasets of subsecond vehicle trajectories along roadway sections. The goal was to encourage the research community to develop new algorithms on driver behavior.

Another successful example is California's Performance Measurement System, a source of archived and real-time data from freeway loop detectors across the State. The data often are combined with other relevant data such as scheduled road closures or travel times collected from toll tag readers.

Another success, the Regional Integrated Transportation Information System (RITIS), integrates multisource archived and real-time data from various member jurisdictions of the I–95 Corridor Coalition, a partnership of transportation agencies along the corridor. The RITIS system, developed and operated

A sample of vehicle probe data transmitted wirelessly from one of the TOL's Cooperative Vehicle-Highway testbed vehicles, shown here. These data include a detailed "snapshot" of information collected from onboard the vehicle, such as vehicle position, speed, acceleration, and the status of a number of vehicle subsystems such as windshield wipers, lights, brakes, and steering. *Source: FHWA.*



This data visualization reveals insights into the impact of incidents and work zones on the temporal and spatial severity of traffic congestion on a section of the I–495 Capital Beltway around Washington, DC, during a 24-hour period in March 2009. Creative visualization approaches provide unique insights into data that are otherwise left undiscovered. *Source: University of Maryland CATT Lab.*

by the University of Maryland Center for Advanced Transportation Technology (CATT) Laboratory has been extremely innovative in the visualization of integrated transportation data. The CATT Laboratory has applied several advanced techniques such as four-dimensional real-time traffic monitoring (that is, the virtual helicopter), circular dependency graphs that reveal relationships among data elements, and graphical generation of incident timelines to display transportation-related data in ways heretofore unseen in transportation operations.

Despite these advances in transportation data, room for improvement remains. The proliferation of global positioning systems (GPS), cell phones, smartphones, and other wireless mobile devices is creating a data-rich transportation environment that reaches well beyond the previous world of limited data collection at fixed locations along roadways. Mobile devices enable data to be collected in real time across the breadth of the transportation system, in terms of both geographic coverage (that is, all types of roads) and modal coverage (automobiles, transit and freight vehicles, and travelers carrying handheld devices). This wealth of data presents both a challenge and an opportunity to transportation management systems and those that operate them. The potential to assess, in real time, the status of the transportation system across all modes and all types of roads and to use this information to manage the system proactively is the opportunity. The challenge then is how to collect and manage these data in an efficient and effective manner. The Saxton TOL and the Data Resources testbed are poised to address this challenge by conducting and supporting the research needs of the transportation operations community.

The Testbed's Internal And External Roles

As mentioned earlier, the role of the Data Resources testbed (DRT) is twofold: one, it serves the data-related needs of FHWA's other two TOL testbeds; and two, it serves as a resource to the broader transportation research community.

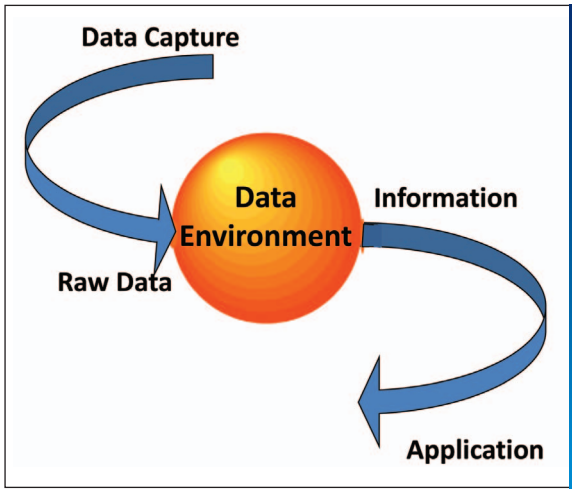
As a component of the larger laboratory, the DRT supports the data-related needs of FHWA's Concepts and Analysis testbed by providing a data repository for computer simulation and analysis input files related to transportation operations. Maintaining a well-managed and well-documented file repository promotes the reuse of simulation models as ongoing "analysis testbeds" for new transportation operations strategies. In addition to efficiencies that the Concepts and Analysis testbed researchers gain by not having to create new simulation model inputs from scratch, they can use those analysis testbeds to compare alternative operations strategies under similar simulated conditions and road networks.

The DRT also serves as a repository for the corresponding simulation and analysis output files related to those analysis testbeds and for any corresponding archived data and real-time feeds if the analysis testbeds are based on real-world transportation networks. The DRT researchers are exploring the integration of analytical results with real-world data or other research data and methods to display those combined data visually.

For the Cooperative Vehicle-Highway testbed, the DRT provides data management and visualization services, making the data available for research and analysis. The DRT supports the management and storage of data collected from the Cooperative Vehicle-Highway testbed's full-scale traffic signal-controlled intersection at the TFHRC facility, two specially equipped vehicles, and numerous sensors, detectors, and other equipment that transmit a variety of data both wirelessly and via more traditional wired communications techniques. Part of the data analysis includes visual displays such as plots of GPS-based position data from vehicles traveling around the TFHRC facility. This particular data acquisition functionality is part of the TOL's role as a testbed for USDOT's ITS research program.

Just as important as the DRT's role as an internal resource for the

Data Environment Conceptual Depiction



Data environments are well organized systems for the collection, management, and provision of multisource data to support transportation operations strategies. The data environment concept is a key tenant for USDOT's ITS Real-Time Data Capture and Management program.
Source: USDOT ITS Real-Time Data Capture and Management Program.

TOL is the testbed's function as an external resource to the broader research community. The intent is to make the data that are collected and managed for TOL research available to the public so the information can be reused in related transportation operations research.

The DRT also can serve as a repository for sample, well-documented, publically available datasets originally collected by others outside of the TOL. In addition to sample datasets, real-time data feeds from select locations and sources may be made publically available through partnerships with State and local transportation agencies, academia, and the private sector. The DRT researchers also will make available demonstrations and examples of interesting and unique data visualizations to inspire creative approaches to data integration and mining, and the presentation of multisource, multimodal data.

Related Research

Researchers with USDOT and the Transportation Research Board (TRB) are actively pursuing many of the DRT concepts. For example, TRB's Strategic Highway Research Program (SHRP 2) Reliability Project L13, Requirements and Feasibility of a System for Archiving and Disseminating Data from SHRP 2 Reliability and Related Studies, recently investigated the feasibility of a research data archive and now is actively pursuing its development. In August 2011, TRB hosted, and FHWA cosponsored, the 6th International Visualization in Transportation Symposium on Data, during which participants exchanged information on current trends and future needs for data visualization.

Perhaps the activity of most relevance to the DRT is USDOT's ITS Real-Time Data Capture and Management program. The role of this research program is to support the development, testing, and demonstration of new and transformative transportation operations services through the provision of multisource, multimodal data. The program is focused on developing and testing data environments to meet the challenges and opportunities of operating transportation systems in a world of pervasive wireless connectivity. As described in "Real-Time Data Capture and Management Program Vision: Objectives, Core Concepts and Projected Outcomes," a data environment is a "well-organized collection of data of specific type and quality, captured and stored at regular intervals from one or more sources, systematically shared in support of one or more applications." The USDOT researchers are developing a research data exchange to serve the ITS research program, and their efforts will be a key feature highlighted within the DRT.

This research data exchange provides both archived datasets and real-time data feeds to support the development of innovative connected-vehicle applications that are designed to better manage U.S. roads and keep congestion at bay. Several archived datasets from the Vehicle Infrastructure Integration (VII) proof-of-concept tests already are available on a prototype data environment. Four new archived datasets also will be available soon, representing Pasadena, CA; San Diego, CA; Portland, OR; and Seattle, WA. The latest information on the USDOT real-time data capture program is available on the ITS Joint Program Office Web site at www.its.dot.gov.

Next Steps

Having just opened in September 2011, the DRT will continue to grow in its role as a resource for both the internal TOL operations and the external research community. The DRT will continue to support USDOT's ITS Real-Time Data Capture and Management program and other data-related research efforts. The development of a data exchange and protocols that support the development and testing of new mobility applications are key ITS research priorities for the DRT in upcoming months.

For the external research community, the DRT will provide open access to new sources and types of data to facilitate research that will build on the paradigm shift from data collection at fixed locations to mobile and multisource data collection across an entire transportation system. The strategy to support internal TOL operations, USDOT research programs, and the external research community allows the DRT to play an important part in supporting the development of new services and applications to operate U.S. roads more efficiently.

Gene McHale is the team leader for transportation-enabling technologies in the FHWA Office of Operations R&D. He is the lead for the DRT and is the modal colead for the ITS Real-Time Data Capture and Management program. He has a B.S. and an M.E. in systems engineering from the University of Virginia and a Ph.D. in civil engineering from Virginia Tech. He is a licensed professional engineer in Virginia.

For more information, contact Gene McHale at 202-493-3275 or gene.mchale@dot.gov.

Along the Road

Along the Road is the place to look for information about current and upcoming activities, developments, trends, and items of general interest to the highway community. This information comes from U.S. Department of Transportation (USDOT) sources unless otherwise indicated. Your suggestions and input are welcome. Let's meet along the road.

Management and Administration

New Research Shows Enforcement Cuts Distracted Driving

Secretary of Transportation Ray LaHood recently announced dramatic reductions in distracted driving in Hartford, CT, and Syracuse, NY. The reductions come after two pilot programs measured the effects of increased law enforcement coupled with high-profile public education campaigns. The findings show that strong laws combined with visible police enforcement can significantly reduce texting and the use of cell phones behind the wheel.

Researchers conducting the two programs examined whether increased police enforcement, along with paid advertising and news media coverage, could reduce distracted driving during four periods of stepped-up enforcement between March 2010 and April 2011. The pilot efforts featured a media campaign theme, "Phone in One Hand, Ticket in the Other," and were structured similarly to the highly successful national "Click It or Ticket" seatbelt campaign.

Before and after each enforcement wave, researchers with the National Highway Traffic Safety Administration (NHTSA) observed cell phone use on roadways and conducted public awareness surveys at driver licensing offices in the two cities. In Syracuse, both handheld cell phone use and texting behind the wheel declined by one-third. In Hartford, where researchers initially identified drivers talking on their cell phones at twice the frequency of those in Syracuse, there was a 57 percent drop in handheld use, and texting behind the wheel decreased by nearly three-fourths.

NHTSA has not yet determined which States will be chosen to expand the program, but plans to test the same three-part formula—tougher laws, stronger enforcement, and ongoing public awareness—statewide in the future.

To download the full report on the pilot programs, visit www-nrd.nhtsa.dot.gov/Pubs/811845.pdf. For more information about USDOT's efforts to eliminate distracted driving, visit www.distraction.gov.

NHTSA

FHWA Report Provides Template For Statewide Freight Plans

The Federal Highway Administration's (FHWA) Office of Freight Management and Operations recently released a report that provides a template that State departments of transportation (DOTs) can use to develop their statewide freight plans. The template is adaptable so a State can choose to use the entire template or just draw on particular parts of it, depending on the State's unique situation.

Freight transportation is complex because it involves many stakeholders who have varying views on how to resolve the challenges facing the industry. One of the biggest challenges for the public sector is incorporating these diverse freight perspectives into the transportation planning process.

The report recommends that States conduct a freight analysis—whether included in the update of a general transportation plan or specifically in a freight plan—during their broader transportation planning processes. It also recommends that States develop their freight plans in coordination with public and private sector entities that are involved with freight movement. According to the report, "Outreach will be a key component of developing an effective freight plan. Developing and fostering relationships with all freight stakeholders will ensure that the plan addresses key issues and concerns of all involved in freight movement in the State."

For more information and to download the report, visit www.ops.fhwa.dot.gov/publications/fhwahop11026/sfp_template.pdf.

Policy and Legislation

First-Ever Fuel Standards Announced For Heavy-Duty Trucks

Under recently announced rules, the Nation's medium- and heavy-duty trucks will be required to meet standards for fuel efficiency and greenhouse gas (GHG) emissions for the first time, beginning in 2014. The standards will save approximately $50 billion in fuel costs over the life of the program. According to NHTSA estimates, trucks and buses built in 2014 through 2018 will reduce U.S. oil consumption by 530 million barrels and GHG emissions by 270 million metric tons.

USDOT and the U.S. Environmental Protection Agency (EPA) jointly developed the national program with support from other stakeholders, including the trucking industry. The joint program will include a range of targets that are specific to diverse vehicle types and purposes. This flexible structure enables significant but achievable fuel efficiency goals to be charted for each year and for each vehicle category and type.

Beyond the direct benefits to businesses that own and operate these vehicles, the program also will benefit

Robert Kyllo/Shutterstock.com

Fuel efficiency standards for trucks like these go into effect in 2014.

consumers and businesses by reducing costs for transporting goods. The program will improve energy and national security, reduce harmful air pollution, and spur job growth in the clean energy sector by fostering innovative technologies and providing regulatory certainty for manufacturers.

For more information, visit www.nhtsa.gov/fuel-economy.

NHTSA

Technical News

Intelligent Asphalt Compaction Analyzer Offers Real-Time Quality Control

Good compaction of newly placed hot-mix asphalt (HMA) is needed to ensure longer lasting performance. Through the Technology Partnerships Program, FHWA and Haskell Lemon Construction Co. of Oklahoma City, OK, developed and tested a quality control tool to assist paving contractors in real time.

The Intelligent Asphalt Compaction Analyzer (IACA) is mounted on pavement rollers and analyzes their vibrations using neural network technology. It relates pavement responses in real time to the contractor's compaction operations. The new technology can take the guesswork out of paving jobs, enabling roller operators to view the information on a monitor and evaluate when the compaction is sufficient.

Independent testing of the device was conducted at nine sites in Missouri, New York, Oklahoma, and Pennsylvania on full-depth HMA. Now that the Technology Partnerships evaluation is complete, project partner Volvo Construction Equipment plans to introduce the IACA as an option on new compactors in the future.

For more information, visit www.fhwa.dot.gov/hfl/partnerships/haskell.cfm.

Oklahoma University

This IACA prototype is installed on a vibratory asphalt compactor. Equipment operators view pavement details on the monitor.

Nation's Largest Solar Highway Project to Power Rest Area

Federal Highway Administrator Victor Mendez recently joined State and local officials in Wilsonville, OR, for a groundbreaking for the installation of a solar array along Interstate 5. The solar array is on 7 acres (2.8 hectares) owned by the Oregon Department of Transportation (ODOT). ODOT officials expect the Baldock Solar Highway project—the Nation's second such project—to be completed and begin generating clean, renewable energy by early 2012.

The Baldock installation will consist of nearly 7,000 panels, each 250 watts, in a 1.75-megawatt array that will produce approximately 1.97 million kilowatt-hours of energy. Some of that energy will power the nearby Baldock Safety Rest Areas on I–5 in Clackamas County, OR.

"Finding sources of renewable energy is in everyone's interest and is consistent with sound transportation policy," Mendez says. The Baldock Solar Highway project reflects State and national policies focused on developing

ODOT

This artist's rendering shows the Baldock Solar Highway outside Portland, OR, which will be the Nation's second and largest highway-related solar installation (the first is also on Oregon's I–5).

sustainable energy resources, will help the State and ODOT meet renewable energy goals, and will create or sustain 60–70 jobs.

The Baldock project is funded through a public-private partnership and will feed energy into the Portland General Electric grid. In addition to green energy, the project will generate renewable energy certificates, certifying the ownership of green power, that will be shared primarily between Portland General Electric and ODOT. FHWA assisted ODOT in the design, environmental review, and issues related to right-of-way and traffic control for the project.

For more information, visit www.oregonsolarhighway.com.

Electronic Document Management Improves Utility Coordination

Each year millions of dollars are spent to relocate or adjust utility facilities prior to road construction projects. Greater emphasis on coordination early in the process can facilitate streamlined utility relocations, expedite project delivery, and reduce the potential for construction delays and extra costs.

Toward that end, a technology implementation group within the American Association of State Highway and Transportation Officials (AASHTO) recently selected the Utility Relocation Electronic Document Management System (UREDMS) as one of its focus technologies. The UREDMS technology facilitates communications and document management to help expedite utility relocation.

A Web-based project planning and construction program, UREDMS provides secure communications, document submission, access to stored documents, and report generation. In addition to a paperless process, UREDMS reduces the need for physical storage space, minimizes lost or misplaced files, and offers a secure environment for transportation agencies and utilities to share information. Further, the system provides a platform to enhance coordination, cooperation, and communications among all stakeholders to help ensure project success.

To encourage use of the UREDMS technology, the AASHTO technology implementation group and FHWA have formed a Lead States Team with representatives from the Georgia, Louisiana, Michigan, Minnesota, New Hampshire, Pennsylvania, and Texas DOTs. Team members are available to provide guidance and answer questions as agencies consider use of this technology.

For more information, visit http://tig.transportation.org/Pages/UtilityRelocationElectronicDocumentManagementSystem.aspx.

AASHTO

Mike Bolden, GDOT

A Georgia Department of Transportation (GDOT) project in Atlanta, GA, is relocating these utilities.

FHWA Report Highlights Reclaimed Asphalt Pavement Use

Many State DOTs are looking at increasing their use of reclaimed asphalt pavement (RAP) to conserve natural resources and save money. A new report from FHWA, *Reclaimed Asphalt Pavement in Asphalt Mixtures: State of the Practice* (FHWA-HRT-11-021), highlights RAP use across the United States. The report also describes best practices for increasing the percentage of RAP used in HMA pavements while maintaining high-quality infrastructure.

The use of RAP enables DOTs to reduce the need for virgin aggregate, a scarce commodity that in some regions necessitates high transportation costs. Using RAP also reduces the amount of costly new asphalt binder required to produce paving mixtures. In addition to lowering project costs, by using RAP, State agencies can decrease the construction debris added to landfills.

Analyses of test sections containing 30 percent RAP showed similar performance and pavement life when compared to virgin asphalt sections. The test sections were part of FHWA's Long-Term Pavement Performance program and were located across the United States and Canada.

For more information and to download the report, visit www.fhwa.dot.gov/publications/research/infrastructure/pavements/11021/index.cfm.

Public Information and Information Exchange

Now Available: *State Best Practice Policy for Medians*

Safety is USDOT's number one priority, and that includes providing safe and effective accommodation of pedestrians wherever possible. Recently, FHWA's Office of Safety published the *State Best Practice Policy for Medians* (FHWA-SA-11-019), which details the benefits of raised medians and highlights three State DOTs—Florida, New York, and Oregon—that have implemented policies and plans to promote their use.

FHWA encourages State and local agencies to consider raised medians in curbed sections of multilane roadways in urban and suburban areas, particularly where there

are mixtures of a significant number of pedestrians, high volumes of traffic, and intermediate or high travel speeds. Adding medians and refuge islands to roadways can increase both pedestrian and motor vehicle safety, helping to solve multiple challenges. They enable pedestrians to cross one direction of traffic at a time rather than having to anticipate traffic for the entire width of the road. Raised medians also provide a space to install improved lighting, which can reduce nighttime pedestrian fatalities at crossings by 78 percent. In addition, these countermeasures lower vehicle speeds on the roadway, reduce motor vehicle crashes by 15 percent, decrease delays for motorists by more than 30 percent, and increase the capacity of roadways by more than 30 percent.

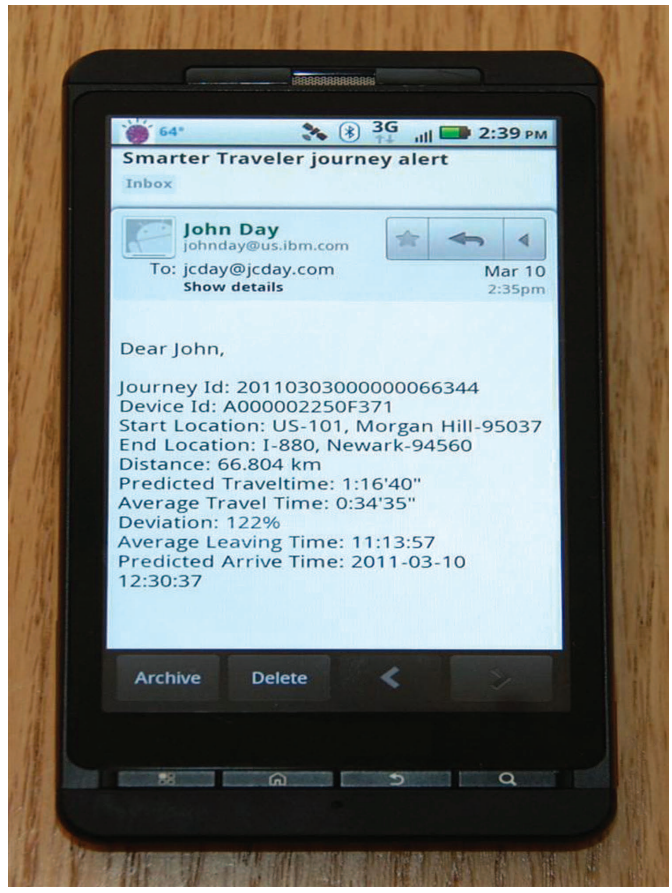
The new publication also addresses budget and maintenance concerns, which can hinder implementation of these policies. To deal with concerns regarding winter road maintenance, for example, the New York State Department of Transportation trained and educated snowplow drivers to increase their confidence and ability to adapt to plowing around this roadway design.

For more information and to download the publication, visit http://safety.fhwa.dot.gov/ped_bike/tools_solve/fhwasa11019.

Smarter Traveler System Helps Commuters Before They Drive

Researchers at the California Department of Transportation, IBM, and the University of California, Berkeley, recently announced a joint research initiative to develop an intelligent transportation solution that will help commuters avoid congestion and enable transportation planners to better predict traffic flow. The Smarter Traveler Research Initiative will use predictive analytics software, global positioning system (GPS) monitoring, and road sensors to build a model of each participating motorist's usual commuting route and then send targeted traffic alerts. The initiative will enable commuters to check a forecast of their route before they leave the house.

Spanning the San Francisco Bay area, the Smarter Traveler project is an opt-in program that uses a participating driver's GPS in his or her mobile phone to develop common routes for a morning commute, for example. These routes are then cross-referenced with real-time traffic data from sensors in the roadways and predictive analytics capabilities to alert the traveler to traffic jams or other potential problems before they even exist. This information will generate alerts that are delivered automatically via email or text message on the status of the driver's typical commute before the trip begins—providing the additional benefit of eliminating potential distraction once the driver is on the road.



IBM

California's Smarter Traveler Research Initiative will build a model of a commuter's route and then send travel alerts via email or text message, such as this one received on a smartphone.

Traffic delays caused by crashes, work zones, or simply daily rush hours routinely cause commuters across the United States to waste on average almost a week's worth of time, 28 gallons of gas, and $808 over the course of a year. The IBM Smarter Traveler alerts will enable drivers to plan alternative routes to avoid congestion and save time and money, while helping transportation agencies reduce bumper-to-bumper traffic through improved traffic signal timing, ramp metering, and route planning.

IBM

YouTube Video Explains Procedures For Setting Speed Limits

The Michigan Department of Transportation (MDOT) and Michigan State Police have released a YouTube video to help motorists understand how speed limits are established. The 1-minute video, which explains the process that State agencies use to set speed limits, is

available on MDOT's YouTube channel at www.youtube.com/michigandot.

As explained in the video, MDOT works closely with partners in law enforcement to establish the safest speed limits possible for the benefit of all motorists. Speed studies are conducted to determine the 85th percentile speed and identify reasonable driver behavior for a particular stretch of roadway. Speed studies are one component of an engineering and traffic investigation and are a nationally accepted guideline for setting speed limits. A survey team in the field identifies and considers other factors, including crash data, traffic volumes, roadside development, roadway configuration and condition, number of intersections and driveways, and sidewalks, all of which may influence road users.

MDOT and police officials note that a comprehensive analysis for determining speed limits relies heavily on identifying normal and safe driver behavior and whether a given speed limit is realistic.

For more information, visit www.michigan.gov/speedlimits. To view the MDOT video, visit www.youtube.com/watch?v=j5pzYoX1cTw.

MDOT

Kentucky Uses RSAs to Support Healthy Communities

The Kentucky Cabinet for Health and Family Services, in partnership with the Kentucky Transportation Cabinet and FHWA's Kentucky Division, recently asked health departments across the State to conduct walkability audits as a part of the State's Healthy Communities initiative. The initiative seeks to improve communities' health through policy, systems, and environmental changes. The agencies established the program in response to Kentucky's 2010 rankings as seventh highest in obesity and sixth lowest in physical activity.

To support the health departments' efforts, the FHWA Office of Safety trained local personnel on road safety audits (RSAs) through 1-day workshops held in the towns of Bowling Green, Frankfort, and London. Nearly 80 people attended the training courses, and participants included representatives from each health department in the area, officials from cities and municipalities where the health departments are planning audits, and representatives from the local highway district offices and area development districts. The training provided an overview of the eight-step RSA process with a focus on pedestrians and also included a field exercise.

The local agencies will use the results from the walkability audits to select streets or roadways to undergo more comprehensive pedestrian road safety audits. Once the RSAs are completed and analyzed, the multidisciplinary review team will submit a report to the appropriate governing bodies.

For more information, visit http://safety.fhwa.dot.gov/rsa.

Reporting Changes of Address

PUBLIC ROADS has two categories of subscribers. One includes the organizations and people who receive the magazine without charge; the editorial office of the magazine maintains the mailing list for this group. The other category is the group of people and companies that pay to receive the magazine; the mailing list for this group is maintained by the Superintendent of Documents for the U.S. Government Printing Office.

Free copies are distributed to offices of the Federal Highway Administration, State highway agencies, technology transfer centers, and selected leaders who have responsibility for highway-related issues. Most of these copies are mailed to offices for their internal distribution or to people by position title rather than by name. If any office or individual subscriber in this category has a change of address, please send the complete previous mailing address and the complete new address to our distribution manager, Paula Magoulas, via email (paula.magoulas@dot.gov), telephone (202–493–3398), or mail (Paula Magoulas, PUBLIC ROADS Distribution Manager (HRTM), Federal Highway Administration, 6300 Georgetown Pike, McLean, VA, 22101-2296).

Paid subscribers who have an address change should notify the U.S. Government Printing Office, Claims Office, Washington, DC, 20402; or call 202–512–1800; or fax 202–512–2168. Please do not send an address change for a paid subscription to the editorial office of PUBLIC ROADS. We do not manage the paid subscription program or mailing list, and we are not able to make the requested change.

Internet Watch

by Alicia Sindlinger

USDOT Office of Inspector General's Home on the Web

The U.S. Department of Transportation's (USDOT) Office of Inspector General (OIG) was established by law in 1978 to provide the Secretary of Transportation and Congress with independent and objective reviews of the efficiency and effectiveness of the department's operations and programs. The OIG's staff of 400-plus employees supports USDOT's priorities of transportation safety and effective program delivery and performance. The office also is tasked with detecting and preventing fraud, waste, and abuse.

To help back the OIG's work, the office maintains a Web site, accessible at www.oig.dot.gov. The site contains a wealth of information about the office, its areas of oversight, and the processes it uses to complete audits and investigations. In addition to disseminating this information, the site also functions as a link to the OIG's Hotline, where USDOT employees, contractors, and the public can report allegations of fraud, waste, abuse, or mismanagement in USDOT programs or operations.

According to OIG officials, the Web site is a key tool in its communications toolkit for keeping the Secretary, Congress, and taxpayers informed because the site is readily accessible to everyone. The site is a place for people to learn about the OIG, stay informed on the outcomes of audits and investigations, and report allegations of fraud, waste, abuse, or mismanagement. A redesign in 2010 made the site more user-friendly.

Finding Information on OIG's Activities

The main functions of the site are to inform stakeholders and raise public awareness of the office's activities. From the home page, visitors have one-click access to information on audits, investigations, and congressional testimonies. The information found in these sections details the processes that OIG staff members follow to conduct their audits and investigations, and summarizes specific audits, investigations, and testimonies. The home page also provides links to the office's email subscription service, Twitter account, and Really Simple Syndication (RSS) feeds for visitors to sign up to receive updates on a regular basis.

From the site's right navigation bar, visitors also can access descriptions of and information about the office's activities in each of the areas that it oversees. Oversight areas include management and financial, aviation, highways, maritime, pipelines and hazardous materials, railroads and transit, and criminal investigations. Each area expands with subcategories that house summaries from audits and investigations in that particular subcategory. For example, under "Highways" users will find the following subcategories: "Highway & Vehicle Safety," "Highways," and "Motor Carrier Safety."

According to OIG officials, the Web site provides invaluable support in helping to meet their obligations to Congress and taxpayers.

Reporting Fraud, Abuse, and Waste

The OIG Hotline Complaint Center, also accessible from the Web site's home page, is an important function of the site. The online form facilitates reporting alleged fraud, waste, abuse, or mismanagement within the department or its programs. Individuals—both internal and external to the department—seeking to report information to the hotline also can call 1-800-424-9071, email hotline@oig.dot.gov, or mail a letter to USDOT Inspector General, 1200 New Jersey Avenue, SE, West Building, 7th Floor, Washington, DC, 20590.

Typical types of fraud, waste, abuse, and mismanagement include the following: contract, procurement, and grant fraud; environment, health, and safety violations; computer crimes; product substitution and counterfeit parts; bribery, kickbacks, and gratuities; false statements and false claims; conflicts of interest and ethics violations; travel fraud; theft or abuse of government property; stimulus abuse such as American Recovery and Reinvestment Act of 2009 violations; and violations of criminal law or the Civil False Claims Act in connection with a Federal contract.

Upon receipt of a specific report, the OIG may open an investigation or audit, refer the matter to USDOT management for appropriate review and action, or refer the allegation to another Federal agency. The hotline operates 24 hours a day, 7 days a week.

For more information, visit www.oig.dot.gov.

Alicia Sindlinger is a contributing editor for PUBLIC ROADS.

Training Update

NATIONAL HIGHWAY INSTITUTE

by Alicia Sindlinger

HSIP Training Hits the Web

Since establishment of the Highway Safety Improvement Program (HSIP) in 2005, the Federal Highway Administration (FHWA) has been leading the way in creating tools and providing guidance to help States improve the safety of their highway infrastructure. FHWA's most recent efforts include developing a series of Web-based training courses through the National Highway Institute (NHI) to help State and local agencies understand and advance HSIP implementation.

With the goal of reducing traffic fatalities and serious injuries on public roads, HSIP requires State departments of transportation to develop and implement a comprehensive statewide plan, called a strategic highway safety plan (SHSP). Until recently, however, there was no training available related to developing and implementing those plans. But now NHI has added five new Web-based courses, including two focused specifically on SHSP development and implementation.

"At FHWA, we continue to work to help States implement HSIP and reach the goals laid out in their strategic highway safety plans," says Karen Yunk, a transportation specialist with FHWA's Office of Safety. "The objective of this series of Web-based courses is to fill the knowledge gap and to make HSIP training opportunities readily accessible to everyone, regardless of location."

Course Descriptions

A team of FHWA and NHI experts developed the following new HSIP and SHSP courses, all of which are now available for scheduling through NHI's Web site.

HSIP Overview (FHWA-NHI-380110). This 1.5-hour Web-based course provides a basic understanding of the purpose of HSIP and the processes for planning, implementation, and evaluation. Because data are the foundation of the HSIP, the course also provides an overview of safety data, including collection and management methods, sources, quality measures, and methods for overcoming data challenges.

HSIP Project Identification (FHWA-NHI-380111). In this 8-hour blended-format course, participants complete 10 online lessons and two instructor-facilitated Web conferences. The course provides the background and information necessary for identifying HSIP projects. Participants learn how to choose between various screening methods. They also learn to identify and evaluate various countermeasures and to prioritize projects based on measures of economic effectiveness.

HSIP Project Evaluation (FHWA-NHI-380112). During this course, participants complete six online lessons and two instructor-facilitated Web conferences. The 5-hour training provides a description of how to evaluate safety effectiveness, an overview of fundamentals needed to perform these evaluations, and information about why

safety effectiveness evaluation is necessary. Participants learn to conduct observational before-and-after studies.

SHSP Development (FHWA-NHI-380113). To help participants gain a basic understanding of the SHSP development process, this 4-hour Web-based course covers the purpose and benefits of SHSPs, the legislative and regulatory requirements, and the importance of data. The course is most appropriate for transportation professionals who are new to or unfamiliar with the SHSP process and for States in the process of updating or planning to update their SHSP.

SHSP Implementation (FHWA-NHI-380114). In this 4-hour course, participants complete three online lessons and five instructor-facilitated Web conferences. Instructors provide strategies and examples of the SHSP implementation processes to help safety partners manage their State's safety plans. The course presents the SHSP Implementation Process Model, which provides a framework to help States assess, compare, and adjust their own implementation efforts.

Scheduling a Session

NHI offers these new courses in two ways: (1) with a particular State as a host agency for in-State participants or (2) with NHI as the host agency with participants from multiple States. For sessions hosted by a particular State, instructors can tailor content to focus on the issues or concerns specific to the host agency. For sessions hosted by NHI, participants from multiple States can learn from the experiences of their peers, particularly during the Web conferences. In either case, the courses highlight the best practices in place today and offer examples of successful implementations.

"These courses are great because of how adaptable they are to an agency's needs," says Yunk. "They can be taken individually or as a series, and their Web-based format ensures that anyone who needs HSIP training can get it."

For full course descriptions or to schedule a session, visit www.nhi.fhwa.dot.gov. For more information, contact Karen Yunk at 609-637-4207 or karen.yunk@dot.gov.

Alicia Sindlinger is a contributing editor for PUBLIC ROADS.

Communication Product Updates

Compiled by Michael Thoryn of FHWA's Office of Corporate Research, Technology, and Innovation Management

Below are brief descriptions of communications products recently developed by the Federal Highway Administration's (FHWA) Office of Research, Development, and Technology. All of the reports are or will soon be available from the National Technical Information Service (NTIS). In some cases, limited copies of the communications products are available from FHWA's Research and Technology (R&T) Product Distribution Center (PDC).

When ordering from NTIS, include the NTIS publication number (PB number) and the publication title. You also may visit the NTIS Web site at www.ntis.gov to order publications online. Call NTIS for current prices. For customers outside the United States, Canada, and Mexico, the cost is usually double the listed price. Address requests to:

National Technical Information Service
5301 Shawnee Road
Alexandria, VA 22312
Telephone: 703–605–6000
Toll-free number: 1–888–584–8332
Web site: www.ntis.gov
Email: customerservice@ntis.gov

Requests for items available from the R&T Product Distribution Center should be addressed to:

R&T Product Distribution Center
Szanca Solutions/FHWA PDC
13710 Dunnings Highway
Claysburg, PA 16625
Telephone: 814–239–1160
Fax: 814–239–2156
Email: report.center@dot.gov

For more information on R&T communications products available from FHWA, visit FHWA's Web site at www.fhwa.dot.gov, the FHWA Research Library at www.fhwa.dot.gov/research/library (or email fhwalibrary@dot.gov), or the National Transportation Library at ntl.bts.gov (or email library@dot.gov).

Exploratory Advanced Research Program Hand-Off Workshops (Brochure) Publication No. FHWA-HRT-11-034

In 2010, the first project awarded under the FHWA Exploratory Advanced Research (EAR) Program concluded. In March and April 2010, two EAR Program workshops involving almost 100 researchers and stakeholders from different fields and sectors reviewed the work of a selection of these projects. Workshop participants assessed which projects had the potential to lead to transformational improvements to planning, building, renewing, and operating safe, congestion-free, and environmentally sound transportation systems.

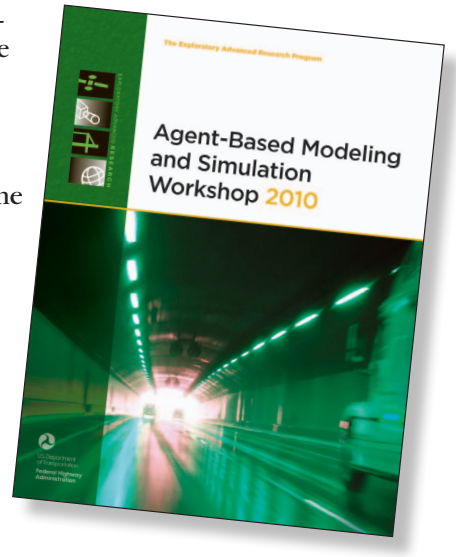
This brochure provides an overview of the 10 projects that were the focus of these workshops. The projects fall into five topic areas: human behavior and travel choices for safety, nanoscale research, human behavior and travel choices for planning, integrated highway system concepts, and technology for assessing performance.

The brochure also highlights a workshop discussion on a California PATH Program project aiming to improve traffic flow and a Colorado School of Mines project that advances intelligent compaction technology. Further, the document includes information about the research life cycle, communication activities, and efforts to advance the research.

The brochure is available at www.fhwa.dot.gov/advancedresearch/pubs/11034/index.cfm. Printed copies are available from the PDC.

Agent-Based Modeling and Simulation Workshop 2010 (Summary Report) Publication No. FHWA-HRT-11-036

Agent-Based Modeling and Simulation (ABMS), an approach to modeling systems that consist of autonomous and interacting agents, can be used to gain in-depth understanding of traveler and driver behavior. In May 2010 at the Turner-Fairbank Highway Research Center in McLean, VA, a panel of agent-based modeling experts presented tools, methods, and concepts related to ABMS at a 1-day workshop convened by FHWA's EAR Program. Following the presentations, speakers and representatives from academia, research organizations, and industry discussed applications to transportation, knowledge gaps, and barriers to implementation.



This summary report covers seven presentations from the workshop and three group discussions. The titles of the presentations are as follows: Agent-Based Simulation and Modeling: Identification of Breakthrough Research for Highway Transportation;

Computer Simulation for Transportation Studies—A Brief History; Overview and Development of Agent-Based Modeling and Simulation; Agent-Based Modeling with Repast Simphony Including a Consumer Products Modeling Example; Using Pattern-Oriented Modeling in Developing the Agent-Based Model of Hawaii's Longline Fishery; Predicting Pandemic Disease Spread in Urban Environments with Agent-Based Simulation; and Agent-Based Modeling of Transportation Systems. Discussion topics include key technical gaps to overcome, challenges of incorporating ABMS in transportation, and potential applications of ABMS in transportation.

The document is available at www.fhwa.dot.gov/advancedresearch/pubs/11036/11036.pdf. Printed copies are available from the PDC.

Improved Corrosion-Resistant Steel for Highway Bridge Construction (TechBrief)
Publication No. FHWA-HRT-11-061

Structural stainless steel ASTM A1010 (UNS S41003) provides corrosion protection for highway bridges subjected to high levels of wetness and high chloride exposures, making painting unnecessary and greatly reducing the need for maintenance. However, the initial cost of stainless steel is more than twice the cost of carbon or weathering steel. This TechBrief discusses research to identify steels with lower potential costs that could be candidates for bridge construction, while still providing low corrosion rates.

To study corrosion, researchers conducted laboratory and field testing on several steels on an existing bridge with a high corrosion rate. The steel samples were subjected to weathering for 1 year. The researchers also conducted a life-cycle cost analysis to examine the benefits of using maintenance-free, corrosion-resistant steel in place of regularly repainting conventional steel. They conducted deterministic and probabilistic life-cycle cost analyses for a bridge intended to have a 125-year service life.


TECHBRIEF

Improved Corrosion-Resistant Steel for Highway Bridge Construction

The researchers found that the combination of strength and impact toughness required for steel bridge members could not be achieved with lower chromium steels. Experimental steels were more corrosion resistant than conventional steels but still required maintenance, such as repainting at certain intervals, for those service environments with high salt exposure.

The document is available at www.fhwa.dot.gov/publications/research/infrastructure/structures/bridge/11061/11061.pdf. Printed copies are available from the PDC.

Conferences/Special Events Calendar

Date	Conference	Sponsors	Location	Contact
April 1–4, 2012	AAPT Annual Meeting and Technical Sessions	Association of Asphalt Paving Technologists (AAPT)	Austin, TX	Eileen Soler 651-293-9188 aaptinfo@gmail.com www.asphalttechnology.org
April 1–5, 2012	NACE Annual Conference	National Association of County Engineers (NACE)	Lexington, KY	Bonnie West 202-393-5041 bwest@naco.org www.countyengineers.org
April 16–18, 2012	25th Annual Geographic Information Systems (GIS) for Transportation Symposium	American Association of State Highway and Transportation Officials (AASHTO)	Loveland, CO	William Johnson 303-512-4808 william.g.johnson@dot.state.co.us www.gis-t.org
April 18–20, 2012	ICRI Spring Convention: Preservation Engineering	International Concrete Repair Institute (ICRI)	Quebec, Canada	Dale Regnier 847-827-0830 dale.regnier@icri.org www.icri.org
May 13–17, 2012	IEEE-IAS/PCA Cement Industry Technical Conference	Institute of Electrical & Electronics Engineers – Industry Applications Society (IEEE-IAS) and Portland Cement Association (PCA)	San Antonio, TX	Corinne Prince-Fields 816-719-0860 corinne.prince@ge.com www.ieeepcaconference.org
May 20–25, 2012	14th International Conference on Alkali-Aggregate Reactions	Transportation Research Board (TRB) and American Concrete Institute	Austin, TX	Sherian D. Williams-Watson 512-471-4527 info@icaar2012.org http://icaar2012.org
May 21–23, 2012	ITS America Annual Meeting & Exposition	Intelligent Transportation Society of America (ITS America)	National Harbor, MD	Nicole Oliphant 202-721-4215 noliphant@itsa.org www.itsa.org/events /majorconferences/2012-meeting
May 22–24, 2012	14th International High Occupancy Vehicle/High Occupancy Toll (HOV/HOT) and Managed Lanes Conference	TRB	Oakland, CA	Richard Cunard 202-334-2965 rcunard@nas.edu www.trb.org/Calendar/Calendar.aspx
May 23–25, 2012	ISAP 2012: International Symposium on Heavy Duty Asphalt Pavements and Bridge Deck Pavements	International Society for Asphalt Pavements (ISAP) and Jiangsu Provincial Communications Department	Nanjing, China	Wu Chunying 86-25-86575445 info@isap2012.net www.isap2012.net

Call for 2012 Award Nominations

Excellence in Highway Design

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- Project Management
- Program and Project Development

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