

# Public Roads

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U.S. Department  
of Transportation  
Federal Highway  
Administration

**Traffic Simulations**  
**Freight Policy Update**  
**CoRe Data Revisited**



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**Front cover**—Double-stack trains, like the one shown here, improve rail productivity. Railroad lines are slowly adding capacity as needed for increases in freight transportation. For more on this subject, see the article, "Freighted With Urgency," by Tony Furst on page 16 of this issue. *Photo by Maersk Line, Ltd.*

**Back cover**—The stainless steel and chrome sculpture shown here depicts early forms of transportation and is one of the features along a walking trail in downtown Asheville, NC. The Asheville Urban Trail celebrates five periods in the city's history and was funded through a Transportation Enhancement grant, administered by the Federal Highway Administration's field office and the North Carolina Department of Transportation's (NCDOT) Enhancements Unit. *Photo courtesy of NCDOT, Charlie Jones Photographer.*





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# Guest Editorial

## A New Year of Challenges and Opportunities

Welcome to 2007! A new year always brings new challenges, along with a renewed sense of optimism and commitment for making positive changes that overcome those challenges.

The recently released 2005 national safety numbers are a sobering reminder of the serious nature of highway safety challenges. More than 43,000 Americans were killed on the Nation's highways in 2005, and for the first time in a generation, the fatality rate (fatalities per 100 million vehicle miles of travel) did not decline. Pedestrian fatalities significantly increased, and motorcycle fatalities continued to rise at an alarming rate.

However, there are existing solutions and new tools and resources that can be brought to bear on the highway safety problem. The August 2005 passage of the Safe, Accountable, Flexible, Efficient Transportation Equity Act—A Legacy for Users (SAFETEA-LU) doubled the funding for the Highway Safety Improvement Program (HSIP). As part of this program, States are required to develop a data-driven, comprehensive Strategic Highway Safety Plan (SHSP). Approximately half of the plans have been completed to date, and all States are expected to have the SHSP development processes approved by October 1, 2007. Other significant SAFETEA-LU provisions included creation and funding of the Federal Safe Routes to School program, creation of a Motorcyclist Advisory Council, additions and enhancements to National Highway Traffic Safety Administration (NHTSA) funding programs, and a strong emphasis on work zone safety.

One of the less visible, but no less important, provisions of SAFETEA-LU is contained in section 1405, Roadway Safety Improvements for Older Drivers and Pedestrians, which calls for improved traffic signs and pavement



markings to accommodate the needs of older drivers, a group that continues to grow as the U.S. population ages. This issue of *PUBLIC ROADS* includes the next article in an ongoing series addressing how the transportation community can better meet the needs and capabilities of older road users—and any improvements made to improve the system for the older population will help everyone. For more information on these and other safety-related SAFETEA-LU provisions, visit the FHWA Office of Safety Web site at <http://safety.fhwa.dot.gov>.

As the new FHWA Associate Administrator for Safety, I have been impressed with the energy and expertise applied to saving lives on the Nation's roads, and I look forward to working with FHWA staff and our internal and external partners to improve highway safety. Let us resolve to work together to make 2007 a year in which the safety numbers move significantly in the right direction.

Jeffrey A. Lindley  
Associate Administrator for Safety  
Federal Highway Administration



# A Model Endeavor

by Vassili Alexiadis, James Colyar,  
and John Halkias

*A public-private partnership  
is working to improve  
traffic microsimulation  
technology.*



**T**raffic analysts today are faced with evaluating diverse and complex solutions to address congestion in transportation systems. Instead of “simply” deciding how many lanes to design for a new freeway or how long the turn bays should be at a traffic signal, practitioners now are analyzing advanced traffic signal and ramp

metering systems, for example, and complex weaving and geometric configurations, intelligent transportation system strategies, multimodal corridor management plans, and congestion pricing strategies.

Traffic microsimulation analysis tools can help evaluate these complex solutions by modeling real-world transportation networks on a systemwide scale that is difficult with more traditional methods. Dramatic improvements in computer processing speeds and capabilities in the past decade have enabled traffic microsimulation software to model increasingly complex and larger scale transportation systems. As a result, microsimulation is quickly becoming popular among traffic analysts

and is playing an important role in transportation investment decisions.

## The Role of FHWA

The Federal Highway Administration (FHWA) is a leader in developing traffic microsimulation models, dating back to the development of NETwork SIMulation (NETSIM) in the 1970s, FREeway SIMulation (FRESIM) in the 1980s, and the merging of NETSIM and FRESIM into a single CORridor SIMulation (CORSIM) model, all of which was integrated into the Traffic Software Integrated System (TSIS) package in the 1990s. In the early 1990s, TSIS/CORSIM was the only viable traffic microsimulation model available to practitioners. By the late 1990s, however, a number of commercial vendors began offering their own versions of traffic microsimulation packages to meet the growing demand. Today, the popularity of microsimulation packages continues to increase, and there is now a viable market for commercial traffic simulation vendors.

In the early 2000s, FHWA re-evaluated its future role in the traffic simulation market. A survey of traffic practitioners and existing traffic simulation packages revealed that while most of the software packages, although robust and providing a range of analysis options, still have some intrinsic limitations that can affect the performance and accuracy of the model results. These limitations in the functionality of current microsimulation systems have generated questions in the transportation community. For example, simulation users view many microsimulation software packages as “black boxes” in that users are not sure how model outputs are

(Above) This photo shows one of seven digital cameras that were mounted atop a building overlooking I-80 near Emeryville, CA. The cameras recorded vehicle movements, which then were used to create a vehicle trajectory dataset, which in turn supported development of a behavior algorithm for driver behavior.



calculated and, as a result, are not confident in the accuracy and validity of the model results.

As a result of the market assessment, FHWA decided to take a different role in the traffic simulation market. Rather than compete with the commercial simulation vendors by continuing to develop TSIS/CORSIM, FHWA would act in a "market facilitator" role by focusing public resources on fostering an environment of public-private coordination through research products that will benefit the entire traffic simulation community: practitioners, vendors, and researchers.

### Enter the NGSIM Program

With the goal of improving the quality and use of traffic microsimulation tools to facilitate transportation decisionmaking, FHWA's Traffic Analysis Tools Program began the Next Generation Simulation (NGSIM) program in 2002. NGSIM is a unique public-private partnership between FHWA, transportation consulting companies, university researchers, and foreign and domestic commercial microsimulation software developers.

The objective of the program is to develop a core of driver behavior algorithms that represent the fundamental logic in traffic microsimulation models, with supporting documentation and validation datasets. NGSIM products will be well documented, openly distributed, and free to the transportation community through the NGSIM Web site ([www.ngsim.fhwa.dot.gov](http://www.ngsim.fhwa.dot.gov)).

"The NGSIM program represents a model public-private partnership that has yielded demonstrable benefits for both sectors," says Nagui Rouphail, chairman of the NGSIM stakeholder traffic modelers group and director of the Institute for Transportation Research and Education at North Carolina State University. He adds, "Here the [U.S.] Government acts as the catalyst for developing sound science and the data to back it up, while the

This computer rendering from a microsimulation modeling program depicts a transportation corridor with two-way traffic, including cars, a bus, a truck, and an exit ramp; a commuter train running parallel to the highway; and an overpass.

### Defining "Algorithm"

Under the NGSIM program, FHWA is sponsoring fundamental traffic simulation research through development of core driver behavior algorithms to help improve the capacity and accuracy of commercial microsimulation software. A core driver behavior algorithm is a mathematical model that attempts to replicate the decisions that drivers continuously make in response to other vehicles. NGSIM focuses on the immediate decisions about when to change lanes, how closely to follow the car in front, and what size of gap to accept when changing lanes or entering an intersection.

private sector commits to participate in the development process as well as incorporating the research findings into its commercial software. This process ensures wider dissemination of the research results and even wider acceptance of the underlying science."

The NGSIM team is composed of traffic simulation and modeling experts managed by a private company. The team is supported by senior advisers from respected transportation institutions across the Nation and includes three stakeholder groups: a *traffic modelers group* that represents researchers and others who develop driver behavior models, a *software developers group* of private vendors responsible for developing and maintaining commercial traffic simulation software, and a *model users group* that represents the practitioners who use traffic simulation models for decisionmaking.

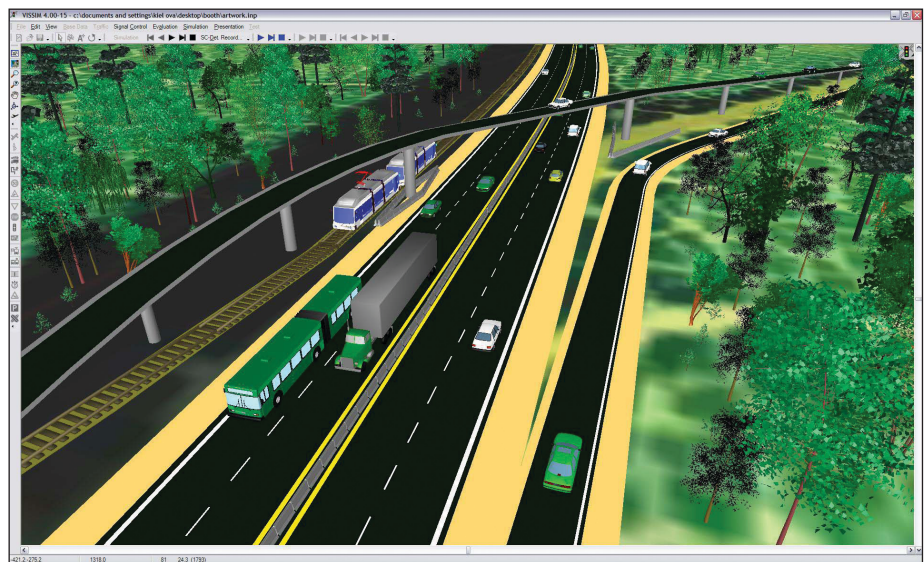
Says Martin Fellendorf, an NGSIM stakeholder in the developers group and also the director of the Institute of Highway Engineering and Transport Planning at the Graz University of Technology in Austria: "So far the NGSIM project has made good progress in bringing together various stakeholders, such as domestic research groups, core users, and foreign software developers. NGSIM is a neutral platform in which competitors can exchange ideas and upcoming developments to the benefit of the users."

Currently, the NGSIM stakeholder team is developing, estimating, coding, and testing the core simulation algorithms. They are using real-world datasets, with their corresponding data descriptions, to estimate and validate the algorithms. The traffic simulation community also is using these datasets to help verify, validate, and calibrate newly developed and existing behavioral models. "I expect these datasets to be a benchmark in comparing simulated data with real-world data," says Fellendorf.

The ultimate goal of the NGSIM program is to improve the quality, trustworthiness, and use of traffic microsimulation models, which will lead to improved decisions by public agencies on transportation investments.

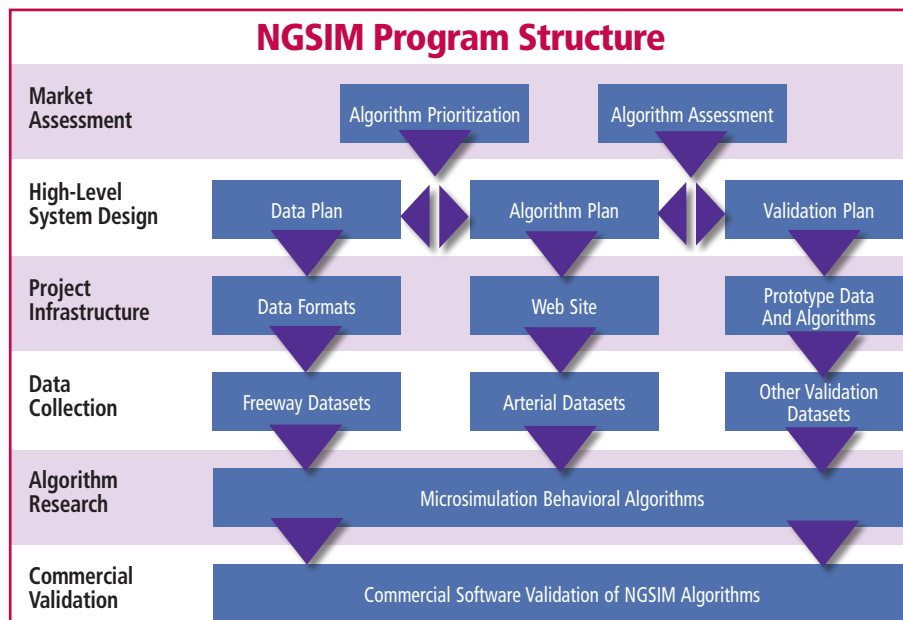
### Getting Started

At the outset, the NGSIM team, together with a variety of experts and stakeholders, conducted a market assessment of traffic microsimulation. The team looked at existing



PTV America, Inc.





microsimulation models, identified the limitations of the models, and prioritized the NGSIM research objective as: improving the core of driver behavior algorithms in microsimulation software.

To accomplish this research objective, the NGSIM team formulated plans for collecting data, developing algorithms, and validating the algorithms. These plans ensured that the research would be conducted through a consistent, rigorous process. The team also developed the project infrastructure for the free and open sharing of data by developing data formats and a Web site for online dissemination of NGSIM products.

The team proceeded to collect and process detailed data on vehicle trajectories on arterials and freeways. The data then were used to develop driver behavior algorithms and then to validate those algorithms with various commercial microsimulation models.

### First Algorithm

Looking at the entire development cycle of an NGSIM algorithm provides an informative cross section of the program. One of the highest ranked algorithm needs identified was in freeway lane selection (FLS).

Existing simulation software models are based on the assumption that drivers evaluate the current and adjacent lanes and choose to change (or not to change) direction based on the relative conditions (for example, average speeds and traffic densities) of these lanes only. But the choice of target lane may require a sequence of

lane changes from the current lane. Because existing models can explain only one lane change at a time, they are not equipped to deal with such relatively complex scenarios.

A good example is roads with high occupancy vehicle (HOV) lanes, which may be significantly more attractive than other lanes to a subset of eligible drivers. Drivers may perform several lane changes to reach the HOV lane, but again, current models would not account for the HOV lane if it was not adjacent to the current lane.

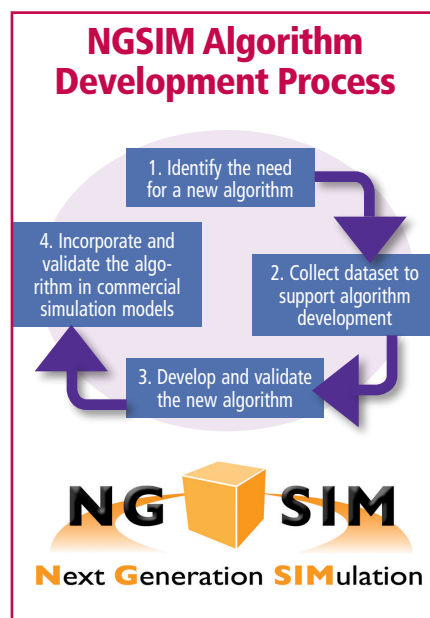
Once the NGSIM team identified the FLS algorithm as a priority, the team began collecting data, drawing on a section of I-80 near Emeryville,

CA. Estimating and validating behavior algorithms requires detailed information on the movements of individual vehicles, as well as other vehicles in the vicinity. Vehicle trajectory data, which include observations of the positions of all vehicles in a section of road, are useful in this context. Almost all vehicle positions are tracked at 0.1-second intervals, resulting in detailed knowledge of lane positions and relationships to other vehicles. The team also collected loop detector data, aerial images, computer-aided design diagrams, and other supporting data. As a result, this and other NGSIM vehicle trajectory datasets are the most detailed and accurate field data collected for traffic microsimulation research and development to date.

One of the university members of the NGSIM team led development of the FLS algorithm. Overall, the process consisted of estimating the algorithm from the I-80 vehicle trajectory dataset, and then validating the algorithm using aggregate data, such as that available from vehicle loop detectors, from the I-80 dataset.

The FLS algorithm consists of a generalized lane-changing model that for the first time explicitly incorporates choice of the ultimate target lane. The lane-changing process consists of two steps: choice of target lane and deciding the minimum acceptable gap in traffic for making the switch. The target lane is the lane the driver perceives as most desirable, considering a wide range of factors and goals.

The algorithm went through an extensive stakeholder review process from its conceptualization to its development and validation. It then underwent rigorous validation in three widely used commercial microsimulation software systems—PTV's VISSIM, TSS-Transport Simulation System's AIMSUN NG, and Quadstone Paramics, developers of which all served on the NGSIM developers' stakeholder group. After that, the team measured the algorithm against real-world aggregate datasets. The developers were involved in the entire process of creating the algorithm, and their willingness to incorporate and validate the algorithm in their own software is evidence of the need for the algorithm and of the success of the partnership developed through the NGSIM program.





## Conclusions

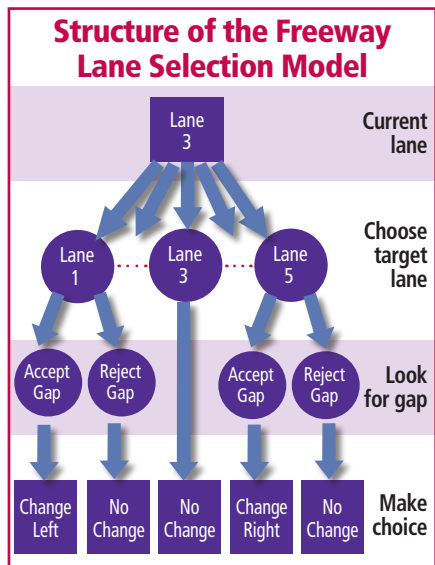
"This particular algorithm proved to be superior with respect to clarity, scientific purity, and comprehensibility," says Fellendorf. "It is much better documented than any of the algorithms embedded so far in any of the commercial simulation packages."

One of the commercial participants in the program, the VISSIM developer, concluded that the NGSIM FLS algorithm is a valuable addition to his company's software and to the state of the art in microscopic traffic flow simulation generally. This conclusion was based on the fact that modeling specialized lanes, especially HOV lanes, is easier and more straightforward in the FLS algorithm compared with the current VISSIM model. Also, the concept of the FLS algorithm is extendible, that is, driving situations not covered in the current version can be added easily into the algorithm's framework. The developer plans to incorporate the NGSIM FLS algorithm in the next full version of VISSIM.

The AIMSUN NG developer determined that the FLS algorithm provides slightly better or comparable results to the existing AIMSUN NG model. He concluded that the main difference lies in the systematic use of the model parameters in the FLS algorithm as opposed to the trial-and-error process in AIMSUN NG. His firm plans to incorporate all the NGSIM algorithms into its commercial software as soon as they become available. The Paramics developer concluded that the FLS algorithm works in a wide range of scenarios and plans on incorporating the FLS algorithm, and additional NGSIM algorithms, into Paramics once the algorithms become available.

## Additional NGSIM Algorithms

The NGSIM team currently is developing three additional driver behavior algorithms, following the same process it did for the FLS work. The new algorithms include a cooperative/forced freeway merging algorithm that explicitly considers cooperation and competition as drivers maneuver through congested freeway merging and weaving areas, an arterial lane selection algorithm that considers both preemptive lane-positioning behaviors and more aggressive over-



This flowchart illustrates the structure of the freeway lane selection algorithm. First the driver chooses a target lane from any of the five on this sample freeway. Then the driver accepts or rejects the gap in adjacent lanes in order to maneuver to the target lane. The final choice is whether to change lanes.

taking behaviors on congested arterial corridors, and an oversaturated freeway flow algorithm that focuses on car-following and lane-changing behaviors during congested, stop-and-go conditions.

To support development of these algorithms, the NGSIM team has collected two additional freeway datasets (another on I-80 in Emeryville and one on U.S. 101 in Los Angeles, CA) and an arterial dataset (on Lankershim Boulevard in Los Angeles), and is planning to collect a second arterial dataset in Atlanta, GA.

## Enabling Better Decisions

"NGSIM by itself will not bring viable products, but if its core algorithms prove to be superior—as the freeway lane selection [FLS] algorithm already has—then private industry will endorse them and embed them within their own software environments, which will be continuously maintained as long as a solid user base asks for them," Fellendorf predicts.

As a result of incorporating the FLS and other NGSIM algorithms into the widely used commercial microsimulation models, transportation practitioners will be able to use simulation software systems more confidently, knowing the core algo-

rithms were rigorously developed by experts and peers using high-quality, real-world datasets. Improving the core algorithms of these models ultimately will lead to more reliable and valid transportation decisions, crucial in today's age of shrinking transportation budgets and need for efficient transportation investments.

Says Rouphail: "The FHWA NGSIM program has, for the first time in a long time, funded a national effort aimed at the collection and synthesis of several high-quality empirical datasets on driver behavior on freeways and surface streets that will undoubtedly advance the state of the art in microscopic traffic modeling and simulation for decades to come."

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*For more information on the NGSIM program, visit the NGSIM Web site at <http://ngsim.fhwa.dot.gov> or contact Vassili Alexiadis at 510-873-8700 or [valexiadis@camsys.com](mailto:valexiadis@camsys.com), James Colyar at 202-493-3282 or [James.Colyar@fhwa.dot.gov](mailto:James.Colyar@fhwa.dot.gov), or John Halkias at 202-366-2183 or [John.Halkias@fhwa.dot.gov](mailto:John.Halkias@fhwa.dot.gov).*



# Older Drivers at a Crossroads

by David A. Morena,  
W. Scott Wainwright, and Fred Ranck



*Design and operational intersection treatments that simplify traffic movement and driving decisions can improve safety for motorists, both young and old.*

Research into the needs and capabilities of older drivers consistently reveals a list of visual, physical, and cognitive limitations that develop with the aging of the Nation's population. Weakened vision, reduced reaction times, and limited dexterity, though not predictable for any one individual, are expected for the aging population

(Above) The use of overhead lane arrows in Toledo, OH, smoothes traffic flow by helping all motorists, including older drivers, find the proper lane as they approach the intersection.

in general. Couple these vulnerabilities with expanding life expectancy and transportation researchers predict an increasing number of older people with transportation difficulties. In response to the challenges, the transportation community can and is engineering road systems to address these declining abilities and ease the burden on older drivers.

Nowhere are the effects of these demographic changes, and the need for engineering assistance, more evident than at the common meeting of roads—at-grade intersections. According to the FHWA *Highway*

*Design Handbook for Older Drivers and Pedestrians* (FHWA older driver handbook), "The single greatest concern in accommodating older road users, both drivers and pedestrians, is the ability of these persons to negotiate intersections safely." Maneuvering a vehicle through an intersection requires the visual acuity, physical dexterity, and mental processing capacity to make simultaneous decisions regarding lane choice, vehicle speed and alignment, braking, acceleration, and continuous vehicle positioning relative to other vehicles in the intersection. And the most



challenging aspect of intersection negotiation, the FHWA older driver handbook continues, is performing left turns during the permitted (steady circular green) signal phase.

Historically, because most of the driving task is visual, early efforts to improve the road system for older drivers focused on traffic control devices, such as bigger and more reflective signs, brighter markings, and better placement of signs and signals—solutions that address the *visual* challenges faced by many older drivers. But, there are also design and operational changes to the road system that can actually address some of the *cognitive* challenges faced by older drivers. Among these cognitive challenges is the need to constantly process and prioritize multiple streams of changing information at once, such as other vehicle movements, pedestrian movements, signs, pavement markings, and lane alignments.

To help motorists navigate intersections safely, transportation agencies can employ a wide range of intersection design and operational techniques, ranging from traffic signal timing and left-turn only signals to installation of roundabouts. All of these techniques, including those discussed in this article, have the potential to reduce crashes and improve safety for the overall driving population as well as older drivers.

### A Successful Track Record

FHWA safety analysts recently examined the results of several studies on intersection improvements implemented in Iowa, Michigan, and in France. The analysts posed a simple thesis: Any treatment that simplifies traffic movement and driving decisions for the average driver will provide an even greater benefit to older drivers.

The FHWA safety analysts contacted the authors of the intersection improvement studies listed below and asked them to rerun their data to assess

how their study treatments specifically affected older motorists. Although not all of the projects were rigorous studies, the authors were asked to repeat whatever research method they used to calculate crash reductions in general to calculate companion results specific to older drivers.

A study performed by AAA Michigan in 2004 found that the Michigan Department of Transportation improved *signal visibility* at 33 intersections along Woodward Avenue corridor in Detroit by increasing the size of the traffic signal lens from 20 centimeters to 30 centimeters (8 inches to 12 inches) in diameter and by adding new signals and repositioning existing ones to be more in line with motorists' sight lines. These modifications resulted in a 17-percent reduction in crashes involving drivers between the ages of 25 and 64—but a 31-percent reduction in crashes involving drivers 65 and older.

According to the same AAA Michigan study, the cities of Detroit and Grand Rapids, MI, substantially reduced crashes at 13 intersections that had been experiencing a high number of left-turn crashes, by installing *separate left-turn lanes*, along with signal phasing for the turn. As a result, the cities achieved a 66-percent reduction in head-on, left-turn crashes involving drivers younger than 65—but a 73-percent reduction for drivers 65 and older.

The Iowa DOT recently has begun converting roadway corridors, under certain traffic loads, from four-lane to three-lane cross-sections. This change in roadway cross-section provides a safer driving environment by simplifying driving tasks for left-turn movements onto and off the

mainline, both at intersections and at driveways. Iowa State University researchers studied 14 of these converted corridors and documented a 24-percent reduction in the crash rate for all drivers—but a 28-percent reduction for drivers 65 and older. Eight corridors in Michigan were modified similarly, with similar results: The improvements yielded a 25.4-percent crash-rate reduction for all drivers—but a 37-percent reduction for drivers 65 and older.

The city of Troy, MI, *modified yellow and red clearance intervals* on all of its traffic signals to meet current Institute of Transportation Engineers (ITE) guidelines, and then reviewed crash results at the 20 intersections with the highest traffic volumes. The ITE-recommended clearance intervals emphasize an all-red period to protect motorists who enter the intersection near the end of yellow from conflict with cross-traffic. The new signal timing worked: total crashes dropped 18 percent for all drivers—but 42 percent for drivers 65 and older.

Another treatment, the *indirect left turn*, prohibits motorists from turning left at the intersection proper. Instead drivers are directed to a U-turn, either on the mainline or on a crossroad, eliminating the need to turn in the face of oncoming traffic. In April 1992, a Michigan DOT study documented that, where implemented in Michigan, the indirect left turn yielded an injury-crash reduction of 45 percent for all drivers. The author later reworked his study, using age breakpoints at 20, 40, and 60 years of age. The injury crash reduction for drivers aged 60 and older was 52 percent.

Four-lane to three-lane corridor conversions in Iowa, such as the one shown here, have reduced crashes by 24 percent—and even more for older drivers. Photo: Iowa DOT.



## Roundabouts and Older Drivers

Of the many changes that come with age, the following are particularly relevant for drivers as they negotiate intersections: *narrowing of the visual field and the area of visual attention; decreased visual sensitivity to motion; a decline in the abilities to filter out less important information and continuously refocus on what is the most critical information; a decline in the abilities to perform multiple tasks simultaneously and process information from multiple sources; a disproportional increase in perception-reaction time with increase in complexity of the driving situation; and loss of the head, neck, and trunk flexibility needed to rapidly scan an intersection.*

In short, older drivers need more time to perceive and evaluate situations, more time to make decisions and take action, and simpler, narrower scenes to take in—all needs that are well served by the lower traffic speeds and less complex vehicle paths of roundabouts. Events play out more slowly at roundabouts, with ample time for all intersection users to anticipate and adjust to the movements of other vehicles and pedestrians. Vehicle/vehicle conflicts and vehicle/pedestrian conflicts are reduced by about three-quarters and two-thirds, respectively, in single-lane roundabouts, and to a somewhat lesser extent in multiple-lane roundabouts.

Roundabouts are less complicated than conventional intersections controlled by stop signs or traffic signals for several reasons: Traffic threats come from only one direction. Color-coded signal bulbs and ever-cycling phases normally are not used in roundabouts. And the approaching driver need only scan straight ahead for pedestrians and about 30 degrees to the left for slow-moving approaching circulating traffic. Above all, roundabouts eliminate the need to judge gaps in fast head-on opposing traffic.

Because older persons are more fragile, crash severity is especially significant. Roundabouts, intrinsically by design, limit vehicle speeds on entry and in the circulating lane. Roundabouts also separate opposing vehicle paths, thereby virtually eliminating the most serious types of crashes that occur at conventional intersections: head-on, left-turn, T-bone, and red-light running. Crashes that do occur at roundabouts tend to be either rear-end crashes or else low-angle, low-energy merging crashes with low closing speeds of 8 to 16 kilometers per hour, kph (5 to 10 miles per hour, mph). Because kinetic energy increases exponentially with velocity, roundabout crashes dissipate far less energy than those severe crash types at conventional intersections: right angles with closing speeds of 56 to 89 kph (35 to 55 mph) or head-on crashes with closing speeds of 113 to 177 kph (70 to 110 mph).

According to ongoing studies from FHWA and the National Cooperative Highway Research Program, roundabout injury crashes are reduced about 75 percent and fatalities by 90 percent or more compared with those at conventional intersections.

—Ken Sides, City of Clearwater, FL

*Clearwater, FL, has the highest proportion of population aged 65 or older of any U.S. city with populations of 100,000 or more. Clearwater has built five roundabouts and has seven currently in design and five more in the pipeline, for a total of seventeen. All but the first one were proposed by—and strongly supported by—residents.*



**Typical circulating speeds in Clearwater's four one-lane roundabouts such as this one are 18 to 21 kph (11 to 13 mph), and typical approach speeds (measured at the crosswalks) are 23 to 26 kph (14 to 16 mph).**  
*Photo: Ken Sides, City of Clearwater, FL.*

Lastly, the Bretagne-Pays de la Loire district in the French Republic, populated by 6 million people with 25 percent aged 65 or older, has extensive experience with the use of roundabouts. The presence of approximately 4,000 **roundabouts** offers an opportunity to compare the experience of older drivers in roundabouts versus other intersection types. In analyzing the French district's crash data, safety analysts from FHWA noted that drivers 61 and older were involved in 15.5 percent of the injury crashes at conventional intersections but only 12.4 percent

of the injury crashes at roundabouts. The analysts' conclusion: Roundabouts appear to pose less of a safety problem to seniors than other intersections—in that country. One of the benefits to older drivers is that the severity of the crash is less, which is especially significant given their frailty. (See “Roundabouts and Older Drivers” on this page.)

### Preparing Motorists In Advance

One strategy to enhance safety at intersections is to prepare motorists well in advance. According to the

FHWA older driver handbook, older drivers generally do not react more slowly to events that are expected; however, in dealing with unplanned events, such as finding one's vehicle in the wrong lane at an intersection, the handbook says, older drivers “take significantly longer to make decisions about the appropriate response than younger road users, and this difference becomes more exaggerated in complex situations.” Engineers can use any one of several strategies to prepare motorists for safe actions at crossroads.

**Advance street name signs** can help a driver who is searching for and intends to turn at a specific intersection prepare for the turn by providing advance notice of the upcoming intersection. Advance street name signs provide this critical information ahead of the decision point, reducing the need for visual searching, and freeing the driver to concentrate on both the mechanics of the turn and conflict avoidance with other vehicles.

Stand-alone signs that simply show the street name, with or without an additional legend, often are used in white-on-green format in advance of signalized intersections. Recent practice, now required by the 2003 *Manual on Uniform Traffic Control Devices* (MUTCD), is to add a distance, or the legend “Next Signal” to the sign. For a nonsignalized intersection, black-on-yellow street name plaques are commonly attached below intersection advance warning signs. Application of this countermeasure has become more common. Many State departments of transportation (DOTs) and local highway agencies have begun to install advance street name signs before both signalized and nonsignalized intersections on their major roadways.

**Advance traffic signal warning signs with flashers** can alert motorists who are traveling at high speeds on expressways or other high-speed roads and may be caught off guard by traffic signals. The strategy combines a passive sign, such as “Prepare to Stop When Flashing” or a similar message, with an active flasher connected to the traffic signal controller. The flasher starts flashing a few seconds before the change from green to yellow and continues through the red interval and, in some cases, a few



seconds into the green signal as the queue dissipates. At least 14 State DOTs use advance warning signs with flashers before traffic signals on high-speed roads, including California, Illinois, Indiana, Iowa, Kentucky, Maryland, Minnesota, Missouri, Nebraska, Nevada, New Jersey, Ohio, Pennsylvania, and Virginia.

The net effect of this early warning on driver behavior appears to be positive. The Minnesota DOT reports that at a pilot site fitted with advance traffic signal warning signs with flashers, red light violations decreased by 29 percent for all traffic and by 63 percent for trucks. At six intersections studied by the Maryland DOT, advance warning flashers have helped reduce right-angle crashes by 62 percent and rear-end crashes by 36 percent. Like advance street signs, traffic signal warning signs provide drivers, including older drivers, with critical information ahead of the decision point and prepare them for a potential stop before the signalized intersection is reached.

Ohio researchers who studied the treatment in their State caution that some drivers tended to use the advance warning to speed up and try to beat the light. But Traffic Engineering Section Chief Scott Thorson with the Nevada DOT cites the benefit of this countermeasure. The Nevada DOT uses advance warning flashers extensively throughout the State, on any roadway with a regulatory speed limit of 89 kilometers (55 miles) per hour or higher. "The onset of the yellow signal indication creates a dilemma for motorists on high-speed approaches to a traffic signal,"



One of the easiest ways to simplify intersection driving is to post the name of the crossroad well in advance, as shown in these two photos.



Thorson says. "The motorists must decide if they have enough time to stop or if they should proceed through the signal. Nevada DOT installed these systems originally to help motorists know that the green phase of the signal is going to end and that they need to prepare to stop because the signal is going to change to red. We have seen a positive change in the behavior of the traffic stream and a reduction in crashes as a benefit of this type of advance warning system, compared to no advance warning. We are believers."

**Advance lane use signs** indicate the mandatory or allowable use of some or all lanes when approaching an intersection. Advance lane use signs offer older drivers pertinent information at an earlier point in their approach to an intersection, giving them additional time to move their vehicles to the desired location. Commonly used throughout the country, advance lane use signs are often ground-mounted at the side of the road, but for maximum impact at critical locations, they are

placed above the lanes to which they apply. The earlier the information is supplied to the driver, the better, and the best location, as recommended by the MUTCD, is either in advance of the tapers or at the start of added turn lanes. Even where advance placement is not practical and the lane use signs are mounted overhead at the intersection, their bold symbolic designs still can provide valuable assistance to drivers approaching the intersection.

**Advance pavement-marking messages** can be especially beneficial to road-weary drivers. Drivers who become drowsy can develop tunnel vision, where their ability to drive is reduced to the most basic driving task—following the path of the roadway. In this condition, even though a driver's peripheral vision and sign-reading skills may be restricted, he or she may still respond to messages painted on the pavement. Messages placed on the pavement can vary from "Left Lane Closed Ahead" to "Signal Ahead" to interstate or State route markers. Practically any regulatory, warning, or guide sign message can be supplemented by the same message in a pavement marking to provide an extra measure of communication with the driver.

European countries have been using pavement messages extensively for decades, and this concept

Advance warning signs with flashers, coordinated with traffic signal operation, are common in at least 14 States. An example from Naperville, IL, is pictured here.







Traffic messages painted on the pavement in the driving lane, in full view of oncoming motorists, can provide an extra measure of communication with the driver. (Left) Motorists are alerted to an upcoming signal in Irvine, CA. (Right) Route markers on the pavement approaches to this intersection in Orlando, FL, help guide motorists to interstate access.

is coming into more extensive use in the United States. For example, route shield pavement markings such as shown in the photo of Orlando, FL, now are being used in at least five States (Orlando, FL; Maryland; New York State Thruway Authority; Ohio; and Virginia) to give enhanced guidance to motorists.

**Providing or upgrading illumination** at intersections can be especially important to drivers with declining vision, as a disproportionate percentage of crashes occur at night: nationally, half of all fatal crashes occur at night, even though people travel approximately 70 percent fewer miles at that time than they do during the day. Researchers in Illinois, Iowa, Kentucky, and Minnesota who have studied the effects of intersection lighting in their States, particularly in rural areas, all report similar results—a reduction in nighttime crash rate or nighttime crash frequency of 25 to 50 percent.

“Nothing says ‘intersection’ to the motorist more than an upcoming group of poles and signs during the day or an oasis of light during the night,” says Mike Kamnikar, Minnesota DOT District 2 traffic engineer, who credits illumination as at least partially responsible for reducing crashes at a particular intersection in his own

district. Not only is the Minnesota DOT proactively lighting rural intersections on its own roads, says Kamnikar, but “we keep a supply of light poles in our maintenance yard, just so we can respond quickly to local agencies that need the poles to light other rural intersections.”

### Simplify the Turning Decision

The FHWA older driver handbook lists several reasons why executing a left turn in the presence of oncoming vehicles becomes more difficult for drivers as they age. Foremost among them is the age-related decline in the ability to detect a perceived change in the size of a

moving object. It is this visual information—the perceived change in the size of an approaching vehicle—that drivers use to judge the speed and distance of that vehicle, and ultimately, whether the gap in time and space in advance of the approaching vehicle provides enough time to execute the turn. Given this inherent difficulty with the left turn, why not simplify or even eliminate that left-turn task? A small collection of countermeasures do just that.

**Restriping the corridor**, from four lanes (two in each direction) to three (one in each direction plus a shared left-turn lane) can increase safety in a roadway corridor—often without a loss of travel



The extension of left-turn lane markings into an intersection, shown here in Overland Park, KS, is a common treatment to help guide multiple lanes of turning traffic through intersections.





Installation of street lighting at this rural Minnesota intersection helped to stop a pattern of nighttime fatal and injury crashes.

speed through the corridor. The safety potential of conversion to a three-lane cross-section (also called road diets) was so compelling to Iowa DOT officials, based on studies done in Minnesota, Montana, and Washington, that Iowa DOT made this project type a staple of its agency's older driver program at the program's inception in 1999.

"Four-lane roadways that have no separate left-turn lane for drive-ways or intersections often have poor safety records, as well as a reputation for inefficient traffic movement" says Tom Welch, Iowa DOT safety engineer. According to Welch, for low to moderate traffic volumes—up to 15,000 vehicles per day—a road with a single high-quality through lane in each direction, unobstructed by left-turn vehicles waiting for gaps, can handle the traffic demand quite well, for most of the hours in a 24-hour day.

And generally the three-lane roads are safer. Safety research in Iowa and Michigan, reported earlier in this article, confirms the sizeable crash reductions reported in Minnesota, Montana, and Washington for this reduction in through lanes. A look

at the demands on a left-turning driver helps explain why: on the four-lane road, turning left from the mainline requires a motorist to idle in the high-speed, left-through lane of traffic, judging speed and gaps in the oncoming two lanes of traffic. Turning from a side road onto the corridor also is a daunting task, requiring a motorist to judge speed and gap availability in all four lanes of traffic on the main road. When the road is converted to a three-lane cross-section, however, the left-turning tasks become predictably easier, as the turning motorist must judge only one or two traffic streams, rather than two or four as noted above.

In a State ranked 4<sup>th</sup> in the Nation in percentage of population over

age 65, feedback from Iowa's public has been positive. Welch says, "Older road users—drivers and pedestrians as well—report that they are much more comfortable crossing and using these roadways after they have been converted from four lanes to three."

At a conventional signalized intersection, left-turning traffic is given ample time per traffic signal cycle during which to make the turn, but much of this time coincides with through traffic so the driver must navigate through gaps in the oncoming traffic. Generally, a safer strategy, but one that allows fewer vehicles to turn per cycle, is to **prohibit left-turn traffic** when oncoming through traffic has the green light. In protected only left-turn phasing, the left turners usually are given a much shorter but "protected" period to make their turn, taking their cue from a green arrow. The tradeoff for improved safety is less left-turn throughput and additional left-turn delays. Across the country, agencies take different approaches to this tradeoff. The North Dakota DOT takes a safety-based approach, in which protected only left-turn phasing is installed at nearly all approaches with posted speed limits greater than 64 kilometers per hour (40 miles per hour).

This added left-turn lane was part of a city-wide, low-cost safety initiative in Winston-Salem, NC.





Most signalized roadway corridors experience a significant dropoff in traffic volume during the late night and early morning hours. In reaction to this dropoff, a common strategy for road agencies is to switch at least some traffic signals from the red-yellow-green mode to a flashing mode at night. This strategy usually places the main street signal on flashing yellow, thus not requiring traffic to stop, and the side street traffic on flashing red, although sometimes all-way flashing red is used. Although this approach generally reduces travel delay, motorists react less uniformly to the flashing signal operation. For late-night/early-morning corridors that are operated on flashers and are experiencing left-turn or angle traffic crashes, a return to normal operating traffic signal mode—that is, **removing the flashing operation**—is likely to reduce total crashes.

In Winston-Salem, NC, a return to normal operation reduced total crashes by 33 percent and right-angle crashes by 78 percent, during the hours of the day that the flashing operation was or had been in effect. In 1984, the Road Commission for Oakland County (Michigan) also documented that removing signals from flash mode improved road safety. The commission then followed up with a countywide policy prohibiting offpeak flashing signal operation at major intersections.

A variety of design strategies actually **eliminate the direct left turn** at intersections and route left-turning motorists through a median U-turn (Michigan), a right-bearing loop (New Jersey's "jug handle"), or some other method. Even though these strategies require vehicles to travel extra distance, Florida (2001) and Michigan (1992) DOT research both show substantial safety benefits for eliminating the direct left turn at divided highways, although the Florida findings are confined to six- and eight-lane roads.

In a **roundabout** design, what would have been a left-turn movement becomes a right-turn exit off the circulating road. Five State DOTs—Kansas, Maryland, Minnesota, New York, and Wisconsin—now consider a roundabout alternative in every new design or major redesign of an intersection. Of these States, Kansas DOT has 43 existing roundabouts (8 of which are on the State highway system) and several in the construction and design phases; Maryland DOT has built nearly 60 roundabouts on the State system, with another 30 more in progress; and the New York State DOT has built 18, with 100 more in the design stage (70 of which are on the State system).

Some States without formal policies are active in roundabout construction, such as Colorado and Washington. According to Brian Walsh, State traffic design and operations engineer from Washington DOT, "At one point, I counted no less than 41 jurisdictions that have a bona fide roundabout on the ground and no fewer than 5 agencies that have at least five roundabouts apiece."

### Simplify the Turning Mechanics

Engineering strategies also can be used to address some of the other physical limitations that accelerate with age. Range of motion and flexibility in the neck and shoulders typically declines with age, making it more difficult physically to scan the roadway environment.

**Realigning skewed intersections** to

a less demanding 90-degree configuration may be helpful. That is why in 2004 the Nebraska Department of Roads instructed its designers to consider realignment to 90 degrees whenever they are designing or retrofitting a major intersection.

Particularly where there is more than one turning lane, or where the turn angle is not 90 degrees, a **dotted-line marking to delineate the turning path** through the intersection can help guide drivers young and old. Marking extensions assist drivers in maintaining a sufficient distance from other vehicles turning abreast in a multilane turn, avoiding collision with a median nose, and moving into the proper lane upon exiting the intersection. Retroreflective or internally illuminated raised pavement markers are well suited for this application, providing a bright, all-weather navigation aid.

**Providing separate left-turn lanes** at intersections and major driveways can benefit motorists in two ways. Most important, the two travel movements (straight and turn) travel at different speeds, and separating the two speeds reduces the potential for rear-end crashes. Also, when drivers must judge gaps and turn in the presence of oncoming traffic (permitted signal phasing) exclusive left-turn lanes provide the drivers with a safe haven in which to wait for an acceptable gap. A safe haven is a particular benefit to drivers with declining vision and cognitive skills, who might occupy that lane longer than the average user. According to the older driver

A full-width approach shoulder in advance of a commercial driveway, as required by a Michigan DOT field office, provides the older driver with the same pressure-free turning movement as is provided by a right-turn lane.

Michigan DOT







Whether dealing with a sizeable median in Iowa (top) or a narrow median in Phoenix, AZ (bottom), offsetting the left-turn vehicles will give the drivers a better vision of oncoming traffic and simplify their turning decision.

handbook, senior drivers preparing to turn left often prefer to wait for larger gaps, and tend to position their vehicles farther back in the intersection such that they actually require larger gaps to make their turn. Studies in Winston-Salem, NC, and Detroit and Grand Rapids, MI, have shown large crash reductions at locations where left-turn lanes were added to the intersection approach.

Although separate left-turn lanes may be desirable, widening the roadway to provide an additional lane may be impractical or prohibitively expensive, or the additional width may adversely affect pedestrian crossings if constructed without a pedestrian refuge. However, State and local DOTs might consider restriping within existing pavement as a potential solution, particularly in urban areas with lower speeds. Left-turn lane widths as narrow as 2.4 meters (8 feet) and through lanes ranging from 2.7- to 3-meters (9- to 10-feet) wide have been found to be workable in some cases—certainly not as good as normal 3.4- to 3.7-meter (11- to 12-foot) lanes, but safer overall than providing no left-turn lane at all.

As documented in the 1990 National Cooperative Highway Research Program (NCHRP) Report

330 *Effective Utilization of Street Width on Urban Arterials*, using narrower lanes on urban arterials in order to provide left-turn lanes is a very widespread and successful practice. Montgomery County, MD, is one of many jurisdictions that have restriped 14.6- to 15.2-meter (48- to 50-foot) wide urban arterial pavements to provide five lanes, including a center left-turn lane, to improve both capacity and safety.

**Providing a separate lane for right-turn traffic** also offers advantages that benefit older drivers. Similar to the discussion earlier on left-turn lanes, adding a separate right-turn lane segregates the straight and turning traffic movement and has the potential to reduce rear-end crashes. Left-turning drivers use their turn lane to wait for a gap; however, the right-turn drivers use their separate lane to lower their speed to make a comfortable turn. Making a right turn at slower speeds is particularly helpful to older drivers who are more likely than younger drivers to suffer from physical and muscle degeneration that make turning—or turning quickly—difficult. According to a recent news release by the U.S. National Institutes of Health, “Today, 35 million people—13 percent of the U.S. population—are 65 and old-

er, and more than half of them have radiological evidence of osteoarthritis in at least one joint. By 2030, an estimated 20 percent of Americans—about 70 million people—will have passed their 65<sup>th</sup> birthday and will be at increased risk for OA [osteoarthritis].” Osteoarthritis and other arthritic and motion-hindering illnesses can inhibit the task of turning and gripping the steering wheel.

As part of its program to design for older drivers, Iowa DOT has added more and longer right-turn lanes in recent years.

Extra pavement for turning traffic can be provided at driveways as well as intersections. The Michigan DOT has a standing policy that developers must supply a short shoulder taper leading to a commercial driveway. The Muskegon Transportation Service Center, a field office of Michigan DOT, pursued a variation on this shoulder widening requirement, requesting that commercial developers provide a full-width shoulder, the length of which varies based on speed limits. A 4.6-meter (15-foot) taper then is included at the end of each shoulder. “Contractors and developers have bought into the requirements because the price of the additional asphalt is offset by reduced labor costs,” says Transportation Engineer Tim Terry, in the Michigan DOT Muskegon Transportation Service Center. Once the change was made, according to Terry, “motorists have been using the full shoulders as we had anticipated. [The shoulder tapers] have allowed drivers to make a right turn at a comfortable speed, out of the way of through traffic, which seems to be especially beneficial for elderly drivers.”

## Improve Sight Distance For Turning Traffic

When left turns are allowed at an intersection, and particularly when those turns are not protected against oncoming traffic, clear sight distance to approaching vehicles is crucial. One design variable that has been shown to improve sight distance for left-turning traffic is to move or **offset the turn lane** to the left, farther into the median or at least closer to the line of oncoming vehicles. Engineers create a “positive offset” by moving a left-turn lane so far to the left that

left-turning drivers can see all the way past the vehicles in the opposing left-turn lane. Positive offset can be particularly helpful for older drivers who, according to the FHWA older driver handbook, tend not to optimize their position in the turn lane, and then have difficulty judging the speed of oncoming vehicles.

Some State DOTs and local agencies offset left-turn lanes on their divided roadways with wide medians. North Dakota DOT, for instance, began offsetting turn lanes wherever possible in 1999. The Wisconsin DOT designs positive offset left-turn lanes on its high-speed, divided intersections, at both nonsignalized and signalized intersections.

Engineers in Phoenix, AZ, have been building offsets into their left-turn lanes for decades, starting with a dozen intersections in the 1970s. The city's commitment to offsetting left turns shows in several ways. "At a few key intersections," says Traffic Engineer Jim Sparks with the city of Phoenix, "we build intersections wide enough for double left turns. However, instead of using the double, we offset drivers nearly one whole car width, which gives them perfect vision."

Phoenix also excels in the more common urban environment, in which tight right-of-way constricts the addition of pavement, and the existing median width tends to be minimal. Even without curb reconstruction, Phoenix has found ways to create at least some sight advantage for left turners at these locations by restriping within existing pavement. In this situation, according to Sparks, "the striping goal is to offset the left-turn drivers sufficiently from their normal positioning so the driver's eye at least lines up with the outside of the opposing left-

turn vehicle. We can do this, simply by getting the opposing cars offset approximately 2 feet [0.6 meter] from one another, which means both drivers' eyes have no obstruction from opposing left-turn traffic."

Turning left safely off the main road is one challenge. Turning left safely *onto* the main road is quite another. Normally engineers and designers try to provide sight lines for turning vehicles by clearing brush, trees, and, to the extent possible, manmade objects that lie between the roads at each quadrant of an intersection. A problem arises, however, where a right-turn lane has been provided adjacent to the mainline through lane. In this case, the right-turn vehicle, especially if it is a large vehicle, may block the line of sight and view of any trailing mainline vehicles for the crossroad left-turn vehicle. Frequent left-turn movements from this crossroad, coupled with heavy truck or bus traffic using the mainline right-turn lane, are a recipe for trouble.

The solution is to *offset the right-turn lane* anywhere from 1.2 to 2.4 meters (4 to 8 feet) so the driver of the left-turning vehicle on the crossroad can make one final clear sighting down the mainline, past the right-turning vehicle, before moving his or her own vehicle onto the mainline pavement. District 12 of the Kentucky Transportation Cabinet (KYTC) adopted this strategy and now tries to design an offset right-turn lane as needed at all new schools in the district. "I'm sensitive to the possibility of large vehicles blocking small vehicles," says Transportation Engineering Branch Manager Charles Neeley with KYTC District 12. "This strategy directly attacks that problem, providing a valuable line of sight, and often at a relatively low cost."

## A Win-Win Approach

As illustrated above, engineers and designers have at their disposal a wide array of strategies and techniques they can use to improve the safety of traveling through intersections—for all motorists, and older drivers in particular. According to FHWA Chief Highway Safety Engineer Rudy Umbs, "Intersection safety improvements as a whole, though helpful to all drivers, can be especially beneficial to our aging drivers."

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**Fred Ranck** is a safety engineer for FHWA's Safety and Design National Technical Service Team delivering technology and technical support to FHWA division offices and State DOTs across the country. He also is a member of FHWA's MUTCD team. His experience prior to FHWA includes 12 years as city traffic engineer for Naperville, IL, manager of the Highway Traffic Safety Department of the National Safety Council for 6 years, and county traffic engineer for DuPage County, IL, for 12 years. He is a certified professional engineer and professional traffic operations engineer.

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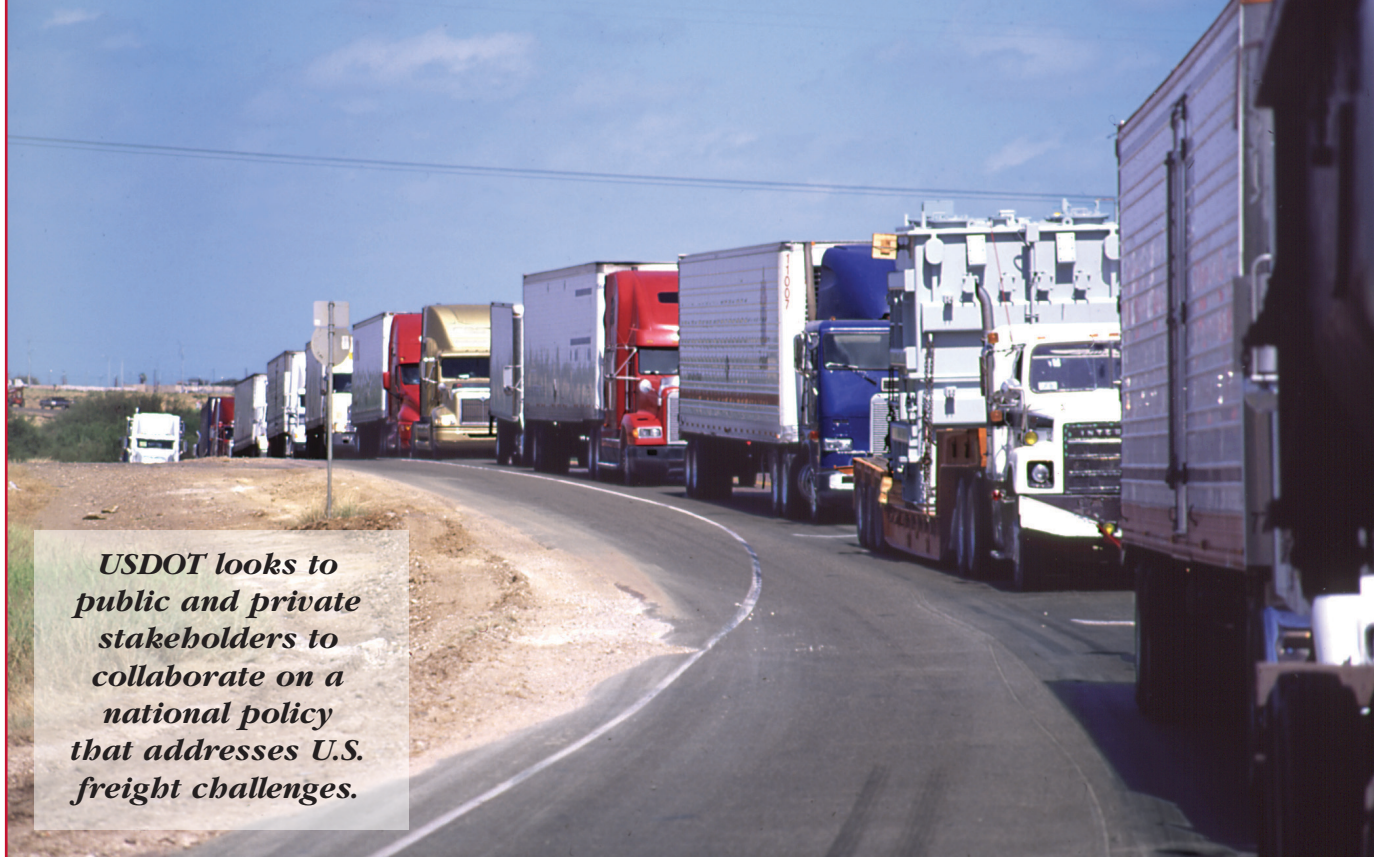
Offsetting the right-turn lane, as shown in this photo from Michigan, provides crossroad traffic with a better view of oncoming mainline traffic, even when large trucks are in the right-turn lane.



## For More Information

Contact personnel and source documents related to the crash reduction statements made in this article for specific intersection-related countermeasures can be found as follows:

| Treatment                                          | More Information                                                                                                                                                                                                                                                                                                                                               | Contact                                                                                                                                                                      |
|----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Signal visibility                                  | <i>Low Cost Intersection Improvements Reduce Crashes for Senior Drivers</i> , ITE 2004 Annual Meeting compendium of papers                                                                                                                                                                                                                                     | Jeffrey Bagdade, Opus International Consultants<br>jeffrey.bagdade@opusinternational.com                                                                                     |
| Separate left-turn lanes                           | <i>Low Cost Intersection Improvements Reduce Crashes for Senior Drivers</i> , ITE 2004 Annual Meeting compendium of papers<br><br><i>Low Cost Safety Improvements: An Update</i> , ITE 2001 Annual Meeting compendium of papers                                                                                                                                | Jeffrey Bagdade, Opus International Consultants<br>jeffrey.bagdade@opusinternational.com<br><br>Stanley Polanis, City of Winston-Salem, NC<br>stanp@cityofws.org             |
| Four- to three-lane cross-section changes          | <i>Before and After Study of Some Impacts of Four-Lane to Three-Lane Roadway Conversions</i> , 2005<br><br><i>Four-Lane to Three-Lane Roadway Conversions: Crash Analysis Data</i> , 2004<br><br><i>Converting Four-Lane Undivided Roadways to a Three-Lane Cross-Section: Factors to Consider</i> , 1999                                                      | Tom Stout, Iowa State University<br>stouttom@iastate.edu<br><br>William Taylor, Michigan DOT<br>taylorw@michigan.gov<br><br>Tom Welch, Iowa DOT<br>tom.welch@dot.state.ia.us |
| Traffic signal timing                              | Correspondence from John Abraham on Troy—Clearance Interval Evaluation, 2005                                                                                                                                                                                                                                                                                   | John Abraham, City of Troy, MI<br>abrahamjk@ci.troy.mi.us                                                                                                                    |
| Indirect left turn                                 | <i>The Comparative Accident Experience of Directional and Bi-Directional Signalized Intersections</i> , 1992<br><br><i>Revisiting the 1992 Directional Crossover Comparative Analysis Study for Age of Driver in Vehicle #1</i> , 2004<br><br>"Right Turns Followed by U-Turns vs. Direct Left Turns: A Comparison of Safety Issues," 2001, <i>ITE Journal</i> | Brett Kach, Michigan DOT<br>kachb@michigan.gov<br><br>Brett Kach, Michigan DOT<br>kachb@michigan.gov<br><br>Lei Xu, PBSJ<br>lxu@pbsj.com                                     |
| Roundabouts                                        |                                                                                                                                                                                                                                                                                                                                                                | Bernard Guichet, CETE de l'Ouest, Nantes, France<br>bernard.guichet@equipement.gouv.fr<br><br>Ken Sides, City of Clearwater, FL<br>ken.sides@myclearwater.com                |
| Advance traffic signal warning signs with flashers | "The Effect of Advanced Warning Flashers on Red Light Running—A Study Using Motion Imaging Recording System Technology at Trunk Highway 169 and Pioneer Trail in Bloomington, Minnesota," 2000, Bob Weinholzer et al.<br><br><i>PTSWF Warning Sign Study</i> , 2006                                                                                            | Robert Weinholzer, Minnesota DOT<br>robert.weinholzer@dot.state.mn.us<br><br>Robert Cunningham, Maryland SHA<br>rcunningham@sha.state.md.us                                  |
| Intersection lighting, particularly in rural areas | <i>Safety Impacts of Roadway Lighting at Isolated Rural Intersections</i> , 2005                                                                                                                                                                                                                                                                               | Howard Preston, CH2M HILL<br>howard.preston@ch2m.com                                                                                                                         |
| Removal of nighttime flashing operation            | "Right-Angle Crashes and Late-Night/Early-Morning Flashing Operation: 19 Case Studies," 2002, <i>ITE Journal</i><br><br>"A Case Study of the Accident Impacts of Flashing Signal Operations Along Roadways," 1987, <i>ITE Journal</i>                                                                                                                          | Stanley Polanis, City of Winston-Salem, NC<br>stanp@cityofws.org<br><br>Gary Piotrowicz, Road Commission of Oakland County, MI<br>gpiotrowicz@rcoc.org                       |



*USDOT looks to public and private stakeholders to collaborate on a national policy that addresses U.S. freight challenges.*

# Freighted With Urgency

*by Tony Furst*

**T**he transportation system that moves the Nation's freight is crucial to the continued economic growth of the United States. The system is closely intertwined with free trade agreements and globally with the increasingly sophisticated supply chain. Volume growth and intermodal connectivity pose significant challenges to the system, particularly at key border gateways. Increased flows are contributing to, and are being affected by, capacity constraints and congestion, which in turn impose higher costs on shippers, consumers, and the environment.

The keys to unlocking these constraints are not just in the hands of the U.S. Department of Transportation (USDOT). Effective solutions will require collaboration by all transportation users and providers.

**(Above)** As the U.S. economy continues to grow, truck-borne freight is expected to increase. In this photo, trucks are backed up near the U.S.-Mexico border at Laredo, TX. Photo: Texas Department of Transportation (TxDOT).

Recognizing the need for such coordination, USDOT developed a national freight policy that encompasses this vast array of transportation providers and users. "The framework enables all stakeholders to work collaboratively toward a safe, reliable, and environmentally sound freight transportation system by focusing their efforts on key objectives," says USDOT Under Secretary for Policy Jeff Shane.

## **The Challenges**

Current pressures on the U.S. transportation system are challenging the efficient movement of freight. In some cases, freight movement itself is responsible for those pressures.

**Highway Congestion.** Since 1980, vehicle miles traveled (VMT) by passenger cars have increased by 50 percent, and VMT by commercial trucks have increased by nearly 100 percent. Coupled with just a 3-percent increase in route miles over the same period, these increases have led to traffic congestion that is becoming steadily worse.

Some 60 percent of major roads are congested during peak periods, which now average 7.1 hours, up from 4.5 in 1982. According to *The 2005 Urban Mobility Report* by the Texas Transportation Institute, congestion delayed drivers by 3.7 billion hours in 2003, with a combined cost in fuel and time of \$63.1 billion.

On one-fifth of the interstate system's mileage, trucks account for more than 30 percent of all vehicles. By 2020, more than 40,234 kilometers (25,000 miles) of highway are likely to carry at least 5,000 commercial trucks each day. The portion of urban interstates with heavy truck traffic (10,000 or more trucks per day) will increase from 27 percent in 1998 to 69 percent by 2020.

According to the Federal Highway Administration's (FHWA) Freight Analysis Framework, woven into this tapestry is the anticipated increase in freight on the Nation's transportation network: from 13.9 billion metric tons (15.3 billion tons) to 23.4 billion metric tons (25.8 billion tons), or 70 percent more, between



1998 and 2020. Trucking will carry a large share of this increase due to growing demands for “just-in-time” delivery, major reductions in railroad track mileage, and the decentralization of manufacturing and consumption patterns.

USDOT has initiated a new National Strategy to Reduce Congestion on America’s Transportation Network to aggressively pursue solutions to roll back the cost of congestion to the transportation network.

**Global Trade.** The U.S. economy continues to undergo profound changes due to globalization. From 1980 to 2003, international trade’s share of gross domestic product increased from 12 percent to 25 percent. This trade volume concentrates freight movement at the Nation’s global gate connections, such as major maritime ports and border crossings made more commercially active by the North American Free Trade Agreement, and severely strains the infrastructure and routes to and from those gateways. These challenges are particularly complex because high-volume freight operations often are located in high-growth, densely populated areas where congestion is already acute and adding new capacity quickly is problematic.

**Rail Capacity.** Although shifting the movement of goods from truck to rail is a frequently cited solution and intermodal traffic is one of the fastest growing segments of the rail industry, railroads will have difficulty absorbing the anticipated growth in containerized freight with their current assets. Mileage of Class 1 railroads has been reduced significantly in the last two decades, and recent service disruptions demonstrate capacity problems on the existing network. That said, the railroads are slowly adding capacity to improve their operations, though they are being cautious in these investments because adding infrastructure is capital intensive and must be amortized over many years.

**Capacity on the Water.** Sufficient ship capacity is online to move increased freight volumes on the sea, and more is being added. Many ocean carriers are building larger

**Double-stack trains, like the one shown here, improve rail productivity.**

vessels: About 250 post-Panamax vessels, which are too large to fit through the Panama Canal, are scheduled for delivery through 2010, with 150 of these vessels having capacities of at least 8,000 twenty-foot-equivalent units (TEU) each. (One TEU denotes 1 standard 20-foot [6.1-meter] cargo container.) Some firms are seriously considering 10,000- and even 12,000-TEU vessels. An 8,000-TEU vessel is as long as an aircraft carrier, draws up to 14.5 meters (47.6 feet) of water, and carries 17 containers across its beam. Because few ports can accommodate 8,000-TEU vessels when they are fully loaded, these vessels may concentrate freight flows through fewer and fewer gateway ports. The land-side impact of these increasingly large container vessels also will be significant. Once these large vessels are off-loaded to truck or rail, congestion issues could strain highway and rail infrastructures that service these port gateways.

**Short Sea Shipping.** USDOT continues to explore the economic viability of “short sea shipping”—movement of goods on inland and coastal waterways, reducing reliance on rail and trucks—to help alleviate highway congestion. Many economic

challenges need to be overcome, but the current highway capacity constraints and rising prices in the rail and trucking industries may well improve the prospects of short sea options.

**Distribution Centers.** Many “big box” retailers are establishing large (92,903-square-meter [1-million-square-foot]) distribution centers close to major gateway ports to cross-dock international cargo from 12.2-meter (40-foot) containers to 16.2-meter (53-foot) trailers, consolidate cargo, and optimize routing through their distribution channels. The retailers also have set up sites near major markets for their goods. These distribution centers are changing the patterns of freight movement, particularly in local areas, and bringing new pressures to bear on the transportation system.

**Environmental Issues.** The Natural Resources Defense Council determined in 2004 that 95 percent of the harmful diesel emissions at

Maersk Line, Ltd.



**Air cargo, although a small percentage of total tonnage, is nevertheless a very fast growing mode of freight delivery.**



Many ocean companies are building increasingly large container vessels. Shown here is the Port of Long Beach, CA.

ports come from ocean vessels, trucks, and cargo handling equipment. A recent FHWA study estimates that freight transportation accounts for approximately half of mobile-source nitrogen oxides (NO<sub>x</sub>) emissions and 27 percent of all NO<sub>x</sub> emissions at the national level. Freight transportation accounts for 36 percent of mobile source PM-10 emissions (particulate matter 10 microns in size) and less than 1 percent of all PM-10 emissions. (The vast majority of PM-10 comes from agricultural fields, wildfires, and fugitive dust.) The environmental impact of freight-related vehicles is a growing issue and in some areas is making the economic development argument difficult to advance. The need to address the environmental effects of freight movement is critical.

### The Need for Collaboration

USDOT oversees only a small minority of the components of the U.S. transportation system, making

it impossible for Federal agencies, alone, to initiate major changes in the system. The private sector owns and operates the overwhelming majority of the mobile assets and controls the “when, where, and how” of goods movement. The infrastructure on which those assets move is owned, operated, and maintained, for the most part, by State departments of transportation (DOTs) and local and regional agencies and, in the case of railroads, by the private sector. Consequently, any meaningful freight policy absolutely requires collaboration by both public and private parties. That cooperation is the cornerstone of the Framework for a National Freight Policy.

### The Framework

The framework begins with a vision and objectives, and then drives through to strategies, tactics, and individual tasks and projects that USDOT and its partners in the public and private sectors can pursue to achieve those objectives. It is built around five central themes.

First, this is a framework for *national* freight policy, not *Federal* freight policy. It includes strategies and tactics to be pursued by USDOT and other stakeholders. This theme reflects the fact that the U.S. freight transportation system is a

national and not a Federal system, composed of a vast array of interconnected public and private sector institutions and organizations.

Second, the strategies and tactics will advance more efficiently through public-private *collaboration*. Historically, the public and private sectors have played clearly divided roles in freight transportation: The public sector has built, owned, and operated transportation infrastructure—predominantly highways—and the private sector has used that infrastructure to move freight. This division has limited the opportunities for leveraging private sector efficiencies and expertise when building and operating infrastructure.

Third, *accountability* is essential, and all responsibilities and tasks will have “owners” responsible (held accountable) for implementation.

Fourth, *investment* is critical. The Nation’s freight transportation system is a tremendous asset, and as with any asset it requires investment to maintain its high quality. Public sector investment, including Federal funding, will be insufficient to meet all needs, requiring innovative new financing mechanisms. Going forward, this framework takes a broader perspective, seeking a wide range of public and private investment tools to finance construction and operation of freight infrastructure.

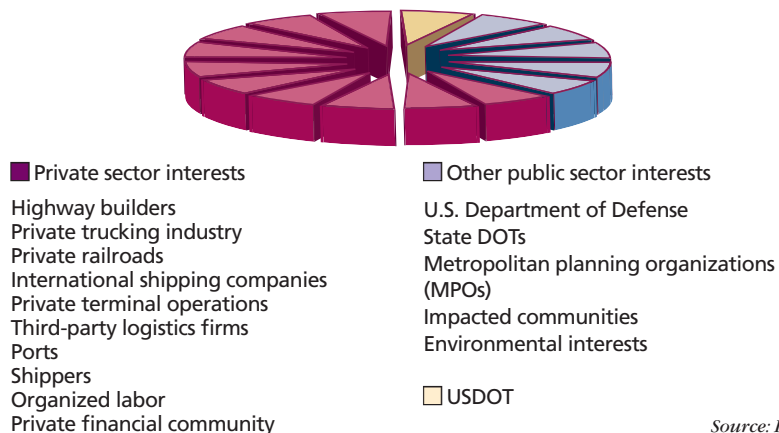
Last, the framework is a *living document*, designed to evolve over time. It must be as dynamic as the freight sector and the economy it serves. The framework will evolve as conditions change and as strategies and tactics are tried and evaluated.

The vision for the framework is akin to what it has been for the U.S. freight transportation system generally: It will continue to “ensure the efficient, reliable, safe, and secure movement of goods and support the Nation’s economic growth while improving environmental quality.”

The framework’s objectives are to accomplish the following:

- Improve operation of the existing freight transportation system
- Add physical capacity to the system in places where investment makes economic sense
- Use pricing to better align all costs and benefits between users and owners of the freight system and to encourage

### Stakeholders in Freight Transportation Policy



Source: FHWA.





- deployment of productivity-enhancing technologies
- Reduce statutory, regulatory, and institutional barriers to improved freight transportation
  - Proactively identify and address emerging transportation needs
  - Maximize the safety and security of the freight transportation system
  - Mitigate and better manage the environmental, health, and community impacts of freight transportation

The seven objectives are intended to support each other, with tactics under one objective generating benefits under others. As a real-world example, PierPASS, a pricing initiative implemented at the port of Long Beach in California, originally was intended to improve freight operations. In the end, it also reduced highway congestion and emissions while decreasing energy consumption.

As a work in progress, the framework does not yet include a full suite of details below the level of individual tactics, nor does it contain all the strategies and tactics that need to be pursued. Currently, in consultation with its public and private sector partners, USDOT is developing a broader range of strategies and tactics, plus specific tasks and responsibilities, to ensure accountability for each tactic. Most tactics will involve efforts by two or more parties, and USDOT's role will vary depending on the particular initiative. The framework, then, unifies all these diverse tactics and initiatives within an overarching national freight policy.

To help the framework's evolution, stakeholders are invited to review the detailed description at [www.dot.gov/freight](http://www.dot.gov/freight) and submit their online input to [freight@dot.gov](mailto:freight@dot.gov).

### Relationship to Congestion Initiative

In May 2006, then-Transportation Secretary Norman Y. Mineta described USDOT's new National Strategy to Reduce Congestion on America's Transportation Network. Some actions being pursued under the congestion strategy are reflected in the Framework for a National Freight Policy, and vice versa. For example, the freight policy includes a number of strategies on public-private partnerships (PPPs) that promote pricing mechanisms to improve performance of the freight network. The strategies include using and promoting new and expanded financing tools to attract private sector investment in transportation projects, exploring opportunities for PPPs and/or privatization, and using public and private sector pricing tools. On a parallel track, the congestion initiative encourages legislation fostering PPP formation in additional States to further enable these partnerships to expand transportation capacity.

### Relationship to SAFETEA-LU

The freight policy draws on some of the freight provisions in the 2005 national transportation law, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). For example, a tactic under both the congestion

initiative and the freight policy is to provide USDOT support for freight projects in SAFETEA-LU's Projects of National and Regional Significance program and the National Corridor Infrastructure Improvement Program. Also, the freight policy supports public sector professional capacity building, as does SAFETEA-LU through its provision on the Freight Capacity Building Program.

### Next Steps

An effective freight policy—or, for that matter, any wise and well-managed change—must start with communication. For this performance-based policy to be achievable, it requires input and participation beyond USDOT from the broader community of freight stakeholders, including both public and private sector interests. Within USDOT, individual offices “own” particular tasks and are accountable for seeing their responsibilities through to completion, but they still need the input of this wider group of stakeholders. USDOT has begun the process of soliciting comments on the framework and looks forward to working with its partners to refine it further. The latest version of the framework is available online at [www.dot.gov/freight](http://www.dot.gov/freight). USDOT would appreciate the questions and feedback of all stakeholders, and ask them to address all correspondence regarding the framework to [freight@dot.gov](mailto:freight@dot.gov).

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# CoRe Concerns

*States are filling their own needs for bridge data beyond parameters outlined a decade ago. Is an update needed?*

*by Adel Al-Wazeer,  
Bobby Harris, and  
Christopher Nutakor*



**T**oday's transportation asset manager faces many competing priorities and must rely on well-defined, high-quality, reliable data based on standards created for infrastructure such as bridges.

For the past decade, most States have employed the model of Commonly Recognized [CoRe] Elements for Bridge Inspection, developed in the mid-1990s by the Federal Highway Administration (FHWA) and American Association of State

Highway and Transportation Officials (AASHTO) to define bridge elements. The CoRe elements standards provide a basis for data collection, performance measurement, resource allocation, and management decisions.

The CoRe standards cover most bridge elements in the States. However, some bridge elements that States want to address cannot be covered using descriptions provided through the CoRe elements. New elements have been defined by States as non-CoRe elements to supplement the CoRe elements defined by AASHTO. Since publication of the *AASHTO Guide for Commonly Recognized Structural Elements* in December 1997, no modifications have been made to accommodate new bridge elements or clarify the description of existing CoRe bridge elements,

or to add new materials in the definition of CoRe bridge elements.

"The 108 CoRe elements, developed some time ago, were a basic start for collecting bridge system information," says Bruce Thill, bridge asset manager at the Washington State Department of Transportation (WSDOT). "Over the years, WSDOT and many other States have found more accurate element data necessary to manage bridge materials, products, and portions of the bridge structure. It would seem reasonable to update the CoRe elements and improve the quality of data based on common management practices or need."

## **FHWA Takes a Look**

A recent inquiry by FHWA may support that view. In 2003, FHWA's Bridge Management Information

(Above) Lights such as these on a bridge over the Potomac River near Shepherdstown, WV, are not included among CoRe elements, but States are devising their own lists for inspection and maintenance purposes and are including such features.

Photo: bd Systems, Inc.



Systems Laboratory (BMIS) gathered data about element-level bridge inspections from the States. The goal of the study was to determine how States use the CoRe standards and what non-CoRe elements the States created to meet their needs.

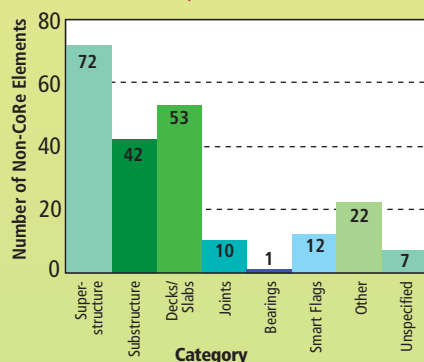
"FHWA is interested in further exploration of potential national uses of element-based bridge inspection data," says Thomas Everett, principal bridge engineer and bridge programs team leader in FHWA's Office of Bridge Technology. "Definition of the CoRe elements was in part intended to establish sufficient uniformity to facilitate data sharing and use across State and local borders. The variability in elements introduced through customization and deviation from the defined CoRe elements raises many questions regarding the usefulness of the data at the national level."

The data from the States arrived in different formats and structures. Some States provided the information following the data structure used by the Pontis® Bridge Management System, the preferred computer-based program for bridge data management developed in 1990–1991 by FHWA and the California Department of Transportation. Pontis includes tables for element definitions, types, categories, and materials.

FHWA's inquiry into how the CoRe model was serving States found shortcomings in various areas. For instance, States felt the need to describe non-CoRe elements not defined among the CoRe elements, describe elements made of different material not described by the CoRe standards, define elements with more details, specify parts of the CoRe elements, and describe the protection systems of elements. One State even described features merely associated with bridges and defined maintenance and equipment related to them.

Using the data gathered from the States, the FHWA BMIS lab further studied a sample of States that provided data using the Pontis data structure. The sample of States included Arkansas, Illinois, Oklahoma, Virginia, and the District of Columbia. Washington State, which did not use the Pontis data structure, also was included because it defined a large number (232) of non-CoRe elements.

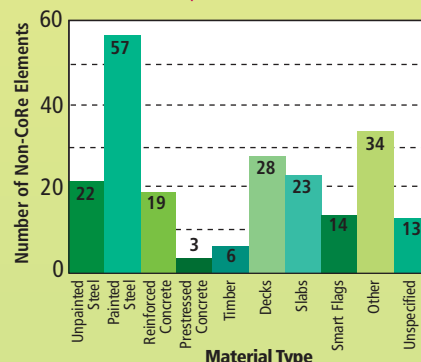
**Distribution of Non-CoRe Elements by Category**  
In a Sample of Five States



Source: FHWA.

Examples of non-CoRe elements defined in the States include sidewalks and retaining walls; girders constructed with rolled, riveted, and welded steel; cantilever span abutments; steel sliding plate joints; and steel finger joints.

**Distribution of Non-CoRe Elements by Material Type**  
In a Sample of Five States



## Reasons for Creating Non-CoRe Elements

Drawing on the available data for a small sample of States that defined non-CoRe elements, the BMIS researchers found the following commonalities in the reasons behind

## Ratings History

Before the CoRe model came online, bridge managers used data based on the National Bridge Inspection Standards (NBIS) to help make decisions. The NBIS approach provided a consistent standard for collecting bridge data, but it was not comprehensive enough to fully support sound management decisions, especially when considering economic factors.

Among the shortcomings was the fact that each bridge was divided into only four major parts for condition assessment: superstructure, substructure, deck, and culverts. With this lack of detail, NBIS was insufficient to identify proper repair strategies or estimate costs. Similarly, each of the four major parts was rated on a 0–9 scale by severity of deterioration, without identifying the deterioration process or its extent.

Another deficiency was that NBIS condition ratings included subjective interpretations of bridge inspection staff. Because the ratings included multiple distress symptoms and were expected to describe the "general" condition of a bridge, inspectors had to decide which distress was the most representative. A general condition might have been difficult to decide when a bridge had mainly localized problems. Finally, an overall sufficiency rating based on NBIS data helped determine Federal funding allocations, but the rating emphasized large-scale functional and geometric characteristics, making it irrelevant for maintenance decisionmaking.

During development of Pontis in the early 1990s, the shortcomings of NBIS were addressed through a standardized description of bridge elements at a greater level of detail, with a roster of up to 160 elements. Each bridge would be characterized by an average of about 10. "This would provide a common nucleus for implementing the system in a large number of States, allow for sharing of bridge management data, and generally would be a significant step forward in the state of the practice of bridge inspection," says Richard Shepard, director of the El Dorado County [CA] Transportation Department and a frequent speaker on bridge management.

As soon as Pontis was completed, several States began applying its standardized elements to their bridge inspections. They wrote their own inspection manuals and provided their own inspector training.

In 1993 under FHWA guidance, a task force was created to revise the standards based on that early experience. The new standard, the Commonly Recognized Elements for Bridge Inspection, would be somewhat more generic than the first version, less tied to Pontis, and with a smaller set (108) of standardized elements. The new approach specified the definition of each element, the unit of measurement, and definitions of a set of three to five standardized condition states, and listed typical feasible actions for each condition state. During AASHTO's Bridge Subcommittee meeting in May 1995, the *CoRe Element Manual* was accepted as an official AASHTO manual.

Around the same time, discussion took place about making the *CoRe Element Manual* a national standard as part of the NBIS, but this never made it to fruition. Instead, FHWA in 1997 developed a translator algorithm to convert the new, more detailed CoRe element condition data into NBIS condition ratings consistent with the old standard. This conversion enabled States to perform inspections under the new standard while still reporting results to FHWA under the old standard.

Even though the *CoRe Element Manual* has not been revised since 1995, most of the States using it have written their own field guides with specific variations, that is, non-CoRe elements. Currently, more than 40 States have made the transition to an element-level inspection standard based on the CoRe elements.

### Distribution of Non-CoRe Elements in the Superstructure Category by Type and Material

| Element Type               | Material            |                      |               |                 |                   |       |
|----------------------------|---------------------|----------------------|---------------|-----------------|-------------------|-------|
|                            | Reinforced Concrete | Prestressed Concrete | Painted Steel | Unpainted Steel | Unspecified Steel | Other |
| Arch                       | 1                   |                      | 1             |                 | 1                 |       |
| Girders/Beams/Stringers    | 4                   | 2                    | 25            | 10              | 4                 | 2     |
| Truss Components           |                     |                      | 11            | 3               | 3                 |       |
| Pins and Hangers           |                     |                      | 1             |                 | 1                 |       |
| Railings/Barriers          |                     |                      |               | 1               |                   | 1     |
| Unspecified Superstructure |                     |                      |               |                 |                   | 1     |

Source: FHWA.

States' definition of non-CoRe elements in their bridge inspection work and recordkeeping:

*To describe elements not included among the CoRe elements.* In many cases, States described various elements on their bridges simply because they were not addressed by the CoRe element descriptions. These elements include, for example, sidewalks, curbs, medians, retaining walls, wing walls (attached to abutments), head walls (in culverts), web walls, spandrel walls, and crash walls.

*To identify material not specified in the CoRe elements.* Materials covered by the CoRe language include steel (painted and unpainted), concrete (reinforced and prestressed), timber, and "other." This was done largely to lessen the ambiguity around some of the materials. For example, painted and unpainted steel were used instead of "other" material for defining non-CoRe pier wall and abutment elements. Examples of non-CoRe elements using materials not specified for CoRe elements include aluminum girders and concrete trusses.

*To specify fracture-critical elements.* Fracture-critical elements are tension members or tension components of members whose failure would be expected to result in the collapse of a bridge. CoRe elements do not include indications as to whether they are fracture-critical. States added this quality to account for fracture-critical elements. Examples of these elements include fracture-critical painted steel welded girders, fracture-critical painted steel bottom chords through trusses, and fracture-critical painted steel through trusses—with "fracture-critical" as the new qualifier of existing CoRe elements.

*To add more details to CoRe elements.* A CoRe element's definition may not be precise enough from a State's perspective. States added details to define some elements more fully. Examples include specifying a column, pier wall, or abutment as having a stone fascia cover; specifying a concrete slab as hollow, a concrete deck as precast, and a concrete girder as post-tensioned; specifying a cable as being in a floating bridge or cable-stayed bridge; and specifying a steel girder as rolled, riveted, welded, or concrete-encased.

*To describe smart flags not included in CoRe elements definitions.* A "smart flag" is used to indicate a critical defect in a bridge. CoRe elements include eight smart flags that describe steel fatigue, pack rust, deck cracking, deck or slab soffit, settlement, scour, traffic impact, and section loss. States added to

### Distribution of Non-CoRe Elements in the Substructure Category by Type and Material

| Element Type         | Material            |               |                 |                   |        |       |
|----------------------|---------------------|---------------|-----------------|-------------------|--------|-------|
|                      | Reinforced Concrete | Painted Steel | Unpainted Steel | Unspecified Steel | Timber | Other |
| Cap                  |                     | 7             | 2               | 1                 |        |       |
| Culvert              | 1                   |               |                 |                   |        | 1     |
| Footings and Piling  | 1                   | 1             | 1               |                   | 1      |       |
| Piers/Columns        | 4                   | 4             | 2               | 1                 |        | 4     |
| Wing Walls/Abutments | 3                   | 1             | 1               |                   | 1      | 5     |

Source: FHWA.

this roster smart flags for erosion control, signing, utility lines, lighting, drains or stream channels, safety inspections, and seismic restrainers.

*To explain more details of the joint/seal elements.* CoRe joint elements include open or strip seal expansion joints and pourable, compression, or modular joint seals. Other joint or joint-seal elements were defined by States as new non-CoRe elements. Examples of the new joints include steel angle header joints, steel sliding plate joints, steel finger joints, and asphalt plug joints. Examples of the new seal elements include premolded seals, silicon rubber seals, concrete seals, steel reinforcement seals, polymer seals, anchored seals, and welded seals.

*To detail part of a CoRe element.* Some States preferred to define part of a CoRe element as a new non-CoRe element. Examples here include abutment back walls, abutment timber bulkheads, girder/stringer/beam ends, and timber deck runners.

*To expand protection systems for decks or slabs.* Seven types of protection systems related to concrete decks or slabs are included as CoRe elements. Some States used more detailed descriptions for the protection systems and defined them as non-CoRe elements. (Oklahoma defined 19 systems for decks and 22 for slabs.)

*To identify protection systems for decks and slabs as separate non-CoRe elements.* Protection systems for concrete decks and slabs are included in the definition of deck/slab CoRe elements. A number of States, however, allocated separate non-CoRe elements to define these protection systems. These elements include asphaltic concrete overlays,

bci Systems, Inc.



This photo of the Rt. 9 bypass over U.S. 340 in Charlestown, WV, depicts two non-CoRe bridge elements: prestressed concrete girders and diaphragms used to tie adjoining girders together to improve their strength and rigidity and to distribute forces laterally.





The stone fascia cover added to this bridge pier provides added protection against scour and debris flows. Photo: bd Systems, Inc.

Some States have opted to add more detail to the joint/seal elements on the CoRe roster. Here, steel finger joints connect portions of a bridge and allow for movement due to weight loadings, temperature changes, and other factors.

Photo: bd Systems, Inc.



rigid concrete overlays, polymer overlays, waterproofing membranes, and stay-in-place steel sheet forms.

*To detail paint/protection systems for steel CoRe elements.* One State used the type of paint or cover for steel elements to redefine CoRe elements into new non-CoRe elements. Examples include lead/non-lead/overcoat-painted steel elements, partially painted weather steel elements, and concrete-encased steel elements.

*To identify paint systems for steel as separate non-CoRe elements.* Similar to defining the protection systems for concrete decks and slabs as new elements, Washington State defined paint systems for steel as new non-CoRe elements. Examples here include red lead alkyd paint systems, zinc/urethane paint systems, coal tar epoxy paint systems, galvanizing protection systems, epoxy paint for weathering steel, and zinc vinyl paint.

*To describe features associated with the bridge.* Some features that exist on bridges but are not

considered integral parts were defined by States as non-CoRe elements. Examples of these include utilities, fencing, lighting, guardrails, and railroad shielding.

*To store maintenance-related information.* One explanation for Washington State defining nearly 200 non-CoRe elements is that it used the element definition table to store other maintenance-related information. Washington was the only State to establish this type of non-CoRe elements definition, and the data are used exclusively to support its bridge maintenance business process.

## Looking Ahead

States vary significantly in their use of non-CoRe elements. Generally, the elements are used to clarify, expand, and otherwise augment the information provided through CoRe elements. Although a standard in CoRe element definitions exists, does the transportation community need more flexibility so that States can more fully support their business models and needs?

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Washington and other States have added such non-CoRe elements as metal pedestrian rails, concrete sidewalks, and pedestrian safety barriers to their roster of data used in bridge inspections and maintenance. This photo taken near Harpers Ferry, WV, captures all three elements.

bd Systems, Inc.





# Accelerated Reconstruction Of I-15 Devore Corridor

**T**ransportation trends in the United States may be converging to form a “perfect storm”<sup>1</sup> for departments of transportation and the public. Few new roadways are being built, and congestion is increasing. Existing roads require more repairs, further disrupting traffic and leading to public displeasure at work zone-related travel delays. These trends only stand to become worse unless the transportation community can craft innovative solutions, such as accelerating urban freeway reconstructions.

According to *The 2005 Urban Mobility Report* by the Texas Trans-

(Above) Innovative construction methods enabled Caltrans to cut the I-15 Devore project from 10 months to 19 days. At the center of this photo, a transformer adjusts a moveable barrier to optimize traffic flow around construction with a dynamic lane configuration.

by Eul-Bum Lee and  
David K. Thomas

portation Institute, from 1982 to 2000 the number of urban areas in the United States with more than 20 hours of annual delay per peak-hour traveler grew from 5 in 1982 to 51 in 2003, caused in part by work zones. During the 2001 peak roadwork season, for example, there were an estimated 3,110 construction work zones on the National Highway System. In the Federal Highway Administration’s (FHWA’s) *Moving Ahead: The American Public Speaks on Roadways and Transportation Communities*, 32 percent of survey respondents expressed dissatisfaction with work zones.

## On the Fast Track In California

As with other States, California is searching for a way to address the problems caused by the converging trends of more congestion, lower budgets, and roads in need of repair. The California Department of Transportation (Caltrans), which oversees a State highway system of 78,000 lane-kilometers (km) (48,467 lane-miles), is achieving some success through its Long-Life Pavement Rehabilitation Strategies (LLPRS) program. The program, initiated in 1998, addresses California’s need for cost-effective practices in rebuilding the aging pavements in its urban highway network. The goal is to rebuild approximately 2,800 lane-km (1,740 lane-miles) of high-volume urban freeway with pavements that are designed to last more than 30 years.

In 2004, Caltrans applied an innovative, fast-track reconstruction program to a heavily traveled LLPRS

*All graphic elements are courtesy of the Institute of Transportation Studies at the University of California, Berkeley, and Caltrans District 8.*



project on I-15 in the city of Devore in southern California. A 4.5-km (2.8-mile) stretch of badly damaged concrete lanes was rebuilt in only two single-roadbed continuous closures (also called “extended closures”) totaling 210 hours, using counterflow traffic (opposite direction to the main traffic flow) and 24-hour-per-day construction operations. Traditional nighttime-only closures would have required 10 months’ work, as estimated on the preconstruction schedule. Instead, the rebuilding took 19 days, with each extended closure for one roadbed lasting 9.5 days.

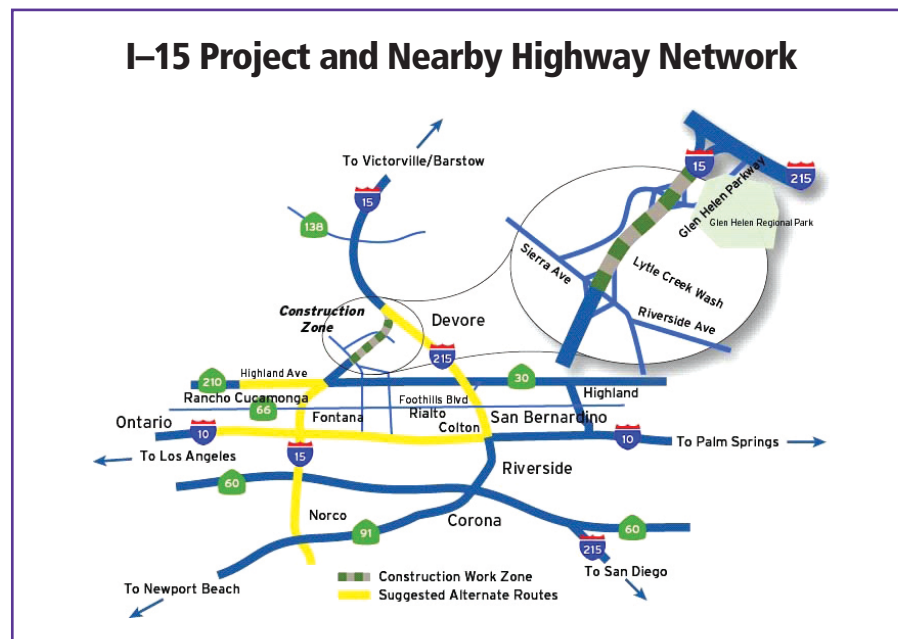
Other innovations adopted for this I-15 Rapid Rehabilitation (Rapid Rehab) project included:

- A moveable barrier system, which provided dynamic lane reconfiguration to minimize traffic disruption
- A rapid-strength concrete mix that made it possible to open the project to traffic 12 hours after its placement, while still allowing for slipform paving in which the form is moved progressively as the concrete is placed
- Incentive/disincentive provisions to encourage the contractor to complete the closures on time
- A multifaceted outreach program to gain public support
- Automated Work Zone Information Systems to update travelers with real-time work zone travel information
- Web-based information systems for disseminating project updates and surveying public reactions

Project engineers used analysis software, which incorporates traffic simulation models, to arrive at an optimal and economical scenario for rehabilitation closures, a construction schedule, and a traffic management plan. The postconstruction data validated the preconstruction analysis and simulation estimates of productivity and traffic delays.

“The [software] model enabled our project engineers to optimize the balance between construction schedule, traffic delay, and agency cost,” says Larry Orcutt, director of Caltrans’s Division of Research and Innovation. “We were further impressed when we found that our postconstruction data validated the predictions made by [the software].”

The public outreach resulted in a 20-percent reduction in traffic demand through the construc-



tion work zone. The maximum peak-hour delay was cut in half, from the expected 90 minutes to 45 minutes. Surveys taken on the project’s Web site showed that public perception of the Rapid Rehab approach shifted dramatically; initial reluctance and objections changed to expressions of support.

“Two months prior to the first roadbed closure, the department had a 1-month hiatus to resequence the approach and staging of the proposed Rapid Rehab work,” says Hector Davila, deputy district director for Caltrans District 8 Construction Division. The advantages of accelerated reconstruction resulted in significant benefits, including a 30-year pavement life expectancy and a 25-percent reduction in construction costs.

“We saw no downside from this Rapid Rehab project,” Orcutt says. “Traffic disruptions were dramatically shorter, and we spent about \$6 million less than we would have if we had used the traditional method with repeated nighttime traffic closures. Not only that, we also found that both worker and motorist safety were improved.”

### Preconstruction Evaluation

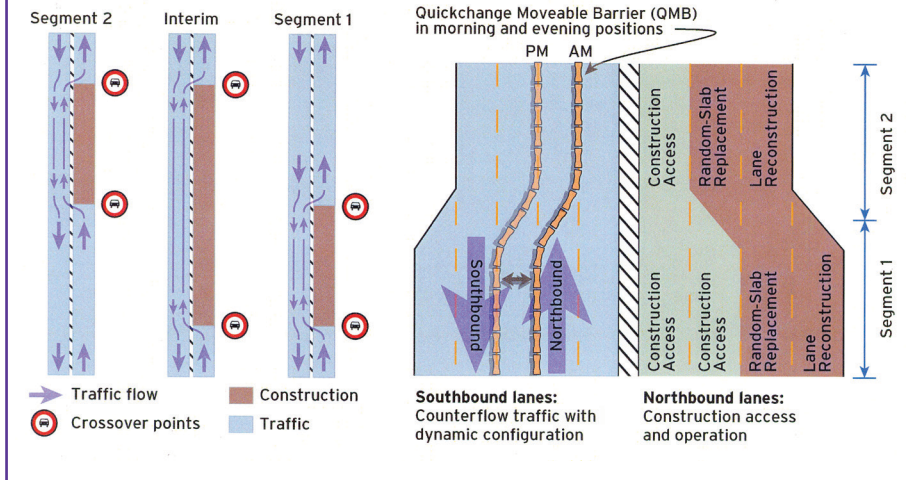
The Devore corridor of I-15 experiences consistently high weekday commuter peaks, including heavy truck traffic, and an even higher volume of 120,000 average daily traffic on weekends when leisure travelers in the Los Angeles area drive to and from Las Vegas and resort locations along the Colorado River.

### Closure Options for I-15 Devore Project

| Closure Scenario       | Schedule Comparison |                  | Traffic Delay        |                         | Cost Comparison   |                                    |
|------------------------|---------------------|------------------|----------------------|-------------------------|-------------------|------------------------------------|
|                        | Number of Closures  | Closures (Hours) | Road User Cost (\$M) | Maximum Delay (Minutes) | Agency Cost (\$M) | Total Cost (\$M) to Users & Agency |
| 72-hour Weekday        | 8                   | 512              | 6.6                  | 75                      | 12.6              | 19.2                               |
| 55-hour Weekend        | 10                  | 550              | 12.7                 | 196                     | 15.1              | 27.8                               |
| One-roadbed Continuous | 2                   | 400              | 6.1                  | 196                     | 9.9               | 16.0                               |
| 10-hour Nighttime      | 220                 | 2,200            | 10.0                 | 36                      | 20.4              | 30.4                               |

The most economical closure scenario was selected based on the analysis software’s estimates from the perspective of closures, schedule, traffic delay, and total cost.

## Progressive Staging Construction and Dynamic Lane Closures



Work on the I-15 project was divided into two segments. While rehabilitation proceeded on the northbound lanes, the southbound lanes were turned over to two-way traffic, with the moveable barrier shifting one lane in the morning and afternoon to accommodate traffic flow.

The project scope called for replacing severely deteriorated concrete slabs and base pavements with a new cross section of 29-centimeter (cm) (11.4-inch) doweled slabs using rapid-strength concrete (Type III) and a 15-cm (5.9-inch) asphalt concrete base of rich bottom (AR-8000) mix on top of the remaining aggregate base or native material.

The preconstruction analysis sought the most economical reconstruction closure scenario while integrating the competing concerns of construction schedule, traffic impact, and agency cost. Four closure scenarios were compared: 72-hour weekday, 55-hour weekend, one-roadbed continuous (24 hours per day, 7 days per week), and 10-hour nighttime. The analysis concluded that the continuous/extended closure scenario would be the most economical.

Compared with traditional 10-hour nighttime closures, the preconstruction analysis indicated that the extended closure scenario would present about 80 percent less total closure time, about 30 percent less road-user cost due to traffic delay, and about 25 percent less agency cost for construction and traffic control.

The result? The I-15 northbound roadbed was closed for reconstruction, and northbound traffic was switched to the southbound side via

median crossovers at the ends of the work zone. Traffic in the two directions shared the southbound lanes as counterflow traffic separated by the moveable barrier. The same process was repeated for reconstruction of the southbound roadbed.

For pavement design and material alternatives, Caltrans used the software model to make comparisons from the perspectives of production scheduling and traffic inconvenience. As a result, Caltrans selected: (1) rapid-strength concrete with a 12-hour curing time rather than fast-setting hydraulic cement concrete with a 4-hour curing time; (2) a 15-cm (6-inch) new AC base, rather than a 15-cm lean concrete base; and (3) a widened 4.3-meter (14-foot)-wide lane, rather than the usual 3.7-meter (12-foot)-wide lane tied to a new concrete shoulder on the outermost truck lane.

High project bids in the first round of construction bidding resulted in altering the rehabilitation scope. The initial scope included reconstruction of two (outermost and adjacent) lanes, but the revised project included reconstruction of only the outermost lane and targeted partial (about 10 percent) slab replacement on the adjacent lane. Moving the project from spring to fall 2004 resulted in a significant 5-percent increase in traffic vol-

ume. Consequently, the road-user cost was estimated to increase by 90 percent, from \$5 million to \$9.5 million, and the estimate of maximum peak-hour queue delay increased from 75 to 90 minutes.

## Innovation and Technology

The I-15 project combined conventional construction materials and operations with state-of-the-practice technologies to expedite construction and minimize traffic impacts. Additional project features that contributed to traffic control included the following:

- A project command center that facilitated department coordination between disciplines (construction, design, traffic, and public affairs) and with other agencies. The command center also enabled remote monitoring of traffic and construction on closed-circuit TV.
  - Caltrans shared information and received constructive feedback from the local community through the High Desert Commuter Advisory Committee.
  - Caltrans allocated \$65,000 to establish free commuter bus service to promote ridesharing. Fourteen buses were added to existing lines serving commuters traveling from the High Desert to the south, increasing overall usage by 40 percent.
  - The Construction Zone Enhanced Enforcement Program improved traffic control and enforcement in the construction work zones and provided \$300,000 that enabled the California Highway Patrol to provide the manpower to issue 1,034 traffic citations during the construction period.
  - The Freeway Service Patrol tow-truck service removed 1,243 disabled vehicles from the work zones at a cost of about \$100,000. Use of the moveable barriers, at a cost of about \$1.5 million, helped to balance traffic impacts to commuters and weekend travelers by providing dynamic lane configuration. In twice-daily operations that required only 30 minutes to complete, each barrier was moved to convert one additional lane temporarily from the rehabilitated asphalt concrete shoulder to accommodate peak directional commute traffic.
- The Devore Project is the first implementation of an automated



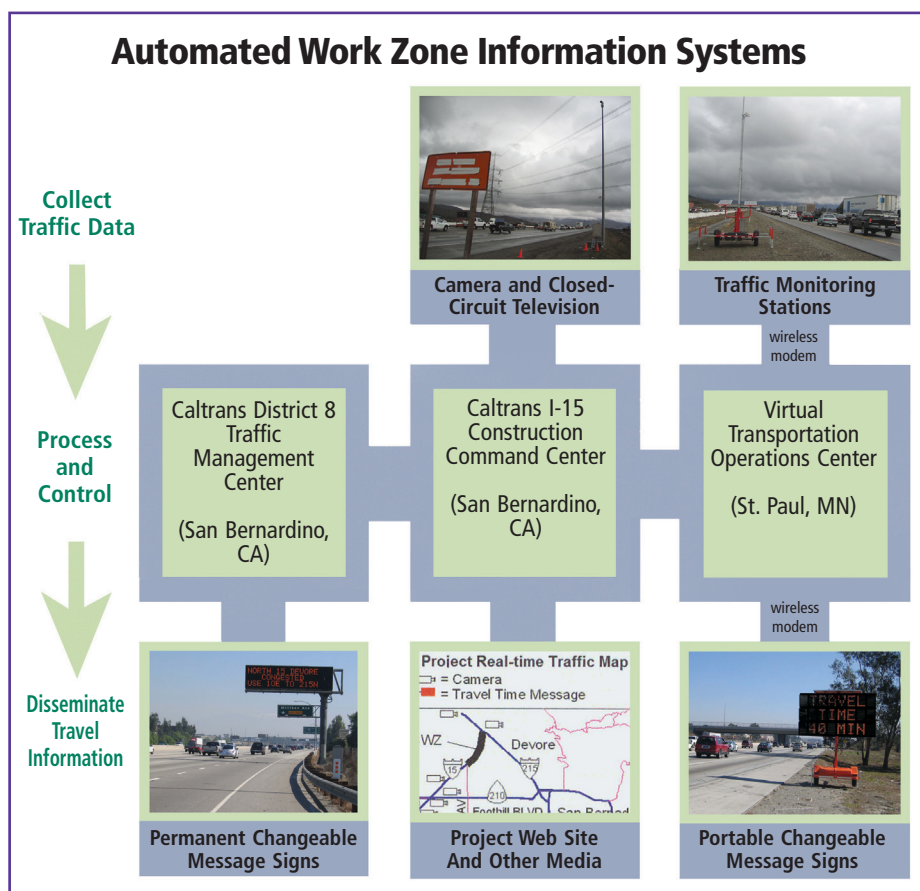
information system in work zones for this type of project in California. "Prior to construction, it was decided to have a 24-hour command center," Davila says. "You could practically run the entire project from this center. There were several monitors displaying the real-time data that were being shown to the public, and camera controls were available to view all the ongoing construction work and traffic flow as it was occurring."

The system provided motorists with real-time information on travel and detour routes. The travel information was posted on permanent and temporary changeable message signs strategically placed at key decision points for roadway users. The information also was posted on a traffic roadmap on the project Web site as part of an interactive public outreach campaign.

### Proactive Public Outreach

Convincing motorists to use alternate routes or adjust their commuting modes to avoid traffic disruption during construction was key to the project's success. Prior to construction, large employers and affected businesses (airports, postal and package-service companies, for example) were informed through project fliers, public meetings, and intensive media outreach. Project planners hoped that the dynamic effort to raise public awareness could prompt a 20-percent reduction in peak-hour traffic demand, but they acknowledged the challenges of targeting daily commuters, the uniqueness of the I-15 Devore corridor, and lack of detour routes close to the construction work zone.

To reduce traffic, Caltrans implemented a media campaign, an outreach program that included public meetings in local communities, a project information Web site, and a project information telephone hotline. Printed materials, including a comprehensive project brochure and construction flyers, were distributed. E-mail contact included a construction advisory electronic bulletin and a "fast-fax" system for project alerts. All these efforts focused on informing the public about the project and providing area travelers with the information required either to divert to alternate routes around the work zones or to time their trips to coincide with construction schedules.



"Our massive public outreach campaign and available data are what made this project a success," Davila says.

### Getting Word Out On the Web

Three months before construction started in October 2004, the project Web site was initiated to provide up-to-date, comprehensive project information. The "I-15 Devore Rapid Rehab Project" Web site appeared as the first headline on the Caltrans District 8 homepage, which linked to the Web sites of neighboring local agencies and the surrounding three Caltrans district offices in southern California. The site was updated regularly with up-to-the-minute information on construction progress, traffic control plans, detour routes, real-time travel information, press releases and fast-faxes for project updates, and community Web surveys.

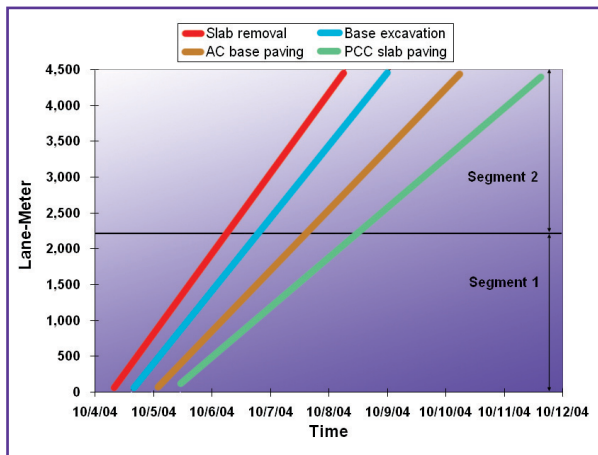
The surveys enabled Caltrans to determine changes in public perception to the Rapid Rehab theme. In the 5 months preceding the extended closures and while the closures lasted, the project Web site received nearly 100,000 hits and played an important role as an interactive

tool to gain input from the public. Community Web surveys indicated that the majority (72 percent) of the people who used the site considered the project information it provided useful to their trip planning.

"We even provided live streaming video of current traffic conditions through the project limits," says Davila. "Traveling motorists were able to log on to our Web site before their trip departure, view traffic conditions, and then decide whether they would drive through the project, take alternate routes, or wait until traffic cleared up."

### Successful Project Implementation

According to a Caltrans's study of the construction, the contractor's production rates reflected a significant learning curve. The majority of operations during the southbound reconstruction, which took place later in the project, showed a 28-percent increase in speed of slab removal and 22-percent faster paving than during the northbound reconstruction. The observed learning-curve effect is attributed to better management by the contractor in the second closure and to the contractor's



The round-the-clock nature of the project and various innovative aspects enabled its four major components to proceed smoothly.

devotion to meeting the scheduled completion date to avoid the late-opening penalty in the incentive/disincentive provisions of the contract.

The continuous lane reconstruction on the outer truck lane exhibited twice the productivity of the random-slab replacement operation on the inner truck lane. For example, slab removal during the continuous-lane reconstruction operation on the southbound construction resulted in more than twice the productivity of the random-slab removal (90 meters/hour versus 37 meters/hour). The lower productivity of random-slab paving for both slab removal and paving was due to these operations requiring extra time for mobilization and demobilization.

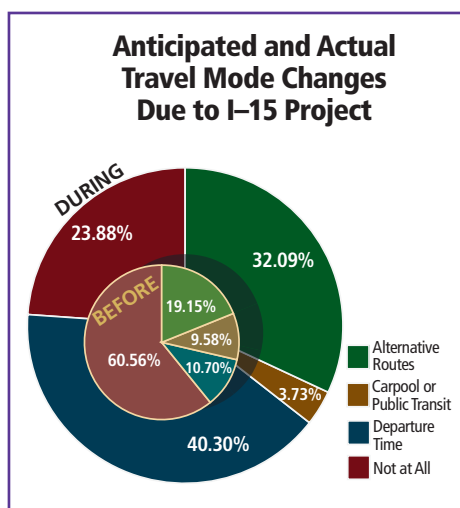
Two critical traffic management goals were met: Overall traffic volume through the work zones was 20 percent less and the maximum peak-hour delay was 50 percent less than projected. Although 90-minute delays were predicted originally for the extended closures in the preconstruction analysis, the maximum peak delay was measured at 45 minutes on weekdays (southbound).

Traffic demand through the work zones was greatly reduced by diversions to major freeway detour routes. Eastbound I-10 was used as the northbound I-15 detour; the replacement showed a 10-percent daily traffic volume increase, with a high of 36 percent during morning peak hours. Southbound I-215 was used as the southbound I-15 detour; it received a daily volume increase of about 15 percent.

Preconstruction survey results also revealed that the public was not initially predisposed to altering its travel patterns and modes to avoid the delays anticipated in the work zones.

However, public perception of the project changed substantially as travelers were able to compare their initial expectations against their actual experiences. Provided with construction schedule information and traffic delay forecasts, a significant percentage of commuters reported changing daily commuting modes and travel routes during the extended closures.

Seventy percent of the respondents to the postconstruction survey expressed support for Rapid Rehab projects, indicating that the California public is willing to bear increased traffic delays for a short period in exchange for compressed construction schedules.



## Public Perception Changes

Before- and after-construction surveys on the project's Web site showed a dramatic change in public perception of the accelerated freeway reconstruction project. Most respondents showed strong initial aversion to the extended closures, with 64 percent of the preconstruction surveys expressing a preference for traditional nighttime or weekend closures and 14 percent requesting complete cancellation of the project.

A traffic monitoring study comparing traffic conditions before and during construction showed that the preconstruction goal of a 20-percent reduction in traffic demand through the work zones during peak hours was achieved, as noted in the previous section, through a combination of "no-shows," diversions, and travel mode changes. Although the preconstruction survey showed that 61 percent of respondents said they would not change their travel patterns even if the I-15 corridor were congested during the construction, only 24 percent of respondents to the during- and after-construction surveys indicated they had not changed their travel plans. Forty percent of respondents reported that they adjusted their departure times based on information obtained through Caltrans's outreach, and 32 percent reported taking detours during the extended closures.

The main contributor to this change in public perception from negative to positive was the comprehensive public outreach program. "This changed the public perception dramatically," Davila underscores.

The I-15 Devore Project team was honored with two Caltrans 2005 Excellence in Transportation Awards, one for public awareness and the other for innovation.

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**David K. Thomas** is an engineering manager for the Parsons Brinckerhoff engineering firm.

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<sup>1</sup> Refers to the 1991 Nor'easter storm, where several severe circumstances converged to cause a catastrophic event off the northern Atlantic coast.

Portions of this article are excerpts from "Rapid Rehab Accelerated Urban Highway Reconstruction: I-15 Devore Project Experience."



# 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

### VDOT Awarded \$1.15 Million for Bridge Research

The Federal Highway Administration (FHWA) has awarded the Virginia Department of Transportation (VDOT) \$1.15 million under FHWA's Innovative Bridge Research and Construction (IBRC) program to use innovative materials on three new Virginia bridges. Virginia is the only State to receive more than \$1 million from this program in 2006.

VDOT, through its research division, the Virginia Transportation Research Council, will use the money toward replacement or building of new bridges on Route 1302 on Tangier Island in the Chesapeake Bay, Route 65 over Staunton Creek in Scott County, and Route 28 in Bristow.

The Tangier Island bridges will replace two timber bridges that are difficult to maintain. The new bridges will have steel trusses with innovative, fiber-reinforced polymer decks that have undergone extensive lab testing at Virginia Polytechnic Institute and State University. Tangier Island has no facilities to provide highway maintenance, so using durable components will reduce the long-term costs of transporting crews, equipment, and materials from the mainland.

The new bridge replacing the current structure on Route 65 will have deck panels made of precast, full-width, full-depth, prestressed concrete, which lends itself to rapid construction and thus less traffic disruption during construction. VDOT will replace the Route 28 bridge with a structure that features self-consolidating concrete in the drilled shafts supporting the structure. This innovative concrete can eliminate undesirable voids in the material as it hardens.

The IBRC program helps State and local governments incorporate new materials and other technologies in bridge work to reduce traffic congestion and maintenance, increase savings and productivity by lowering life-cycle costs, and generally enhance safety.

*A complete list of the grants is available at [www.fhwa.dot.gov/bridge/ibrc/awards.cfm](http://www.fhwa.dot.gov/bridge/ibrc/awards.cfm).*

VDOT

### USDOT Celebrates "Nationwide Ride to Work Day"

On July 19, 2006, more than 50 USDOT employees celebrated the 15<sup>th</sup> annual "Nationwide Ride to Work Day" by riding their cruisers, sports bikes, and even one hand-built chopper to work. The celebration by motorcyclists is not to be confused with "Ride-to-Work Day" sponsored by the League of American Bicyclists.

On "Nationwide Ride to Work Day," motorcyclists are encouraged to ride to work to demonstrate that motorcycles can be an economical and environmentally friendly form of transportation. According to the U.S. Census Bureau and USDOT, more than 80 million cars and light



**These motorcycles belong to some of the 50 USDOT employees who rode their bikes to work in order to support "Nationwide Ride to Work Day."**

trucks are used for daily commuting on the Nation's roads, and about 200,000 motorcycles and scooters are a regular part of this mix. On "Nationwide Ride to Work Day," the practical side of riding becomes more visible as a larger number of the Nation's 8 million cycles are ridden to work.

"Nationwide Ride to Work Day" helps demonstrate how motorcycles make parking easier and help traffic flow better. Studies have shown that across equal distances, commuting motorcyclists reach their destinations in less time than those using automobiles; that motorcycles and scooters consume less resources per mile than automobiles; and that they take up less space on roads.

### Regional University Transportation Centers Named

USDOT's Research and Innovative Technology Administration has designated 10 universities to serve as regional University Transportation Centers (UTC). The universities were chosen as the result of an open competition outlined in Section 5402 of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). Each regional UTC is authorized under SAFETEA-LU to receive up to \$2 million in each of fiscal years (FY) 2007 and 2008, and \$2.2 million in FY 2009, which must be matched dollar-for-dollar with non-Federal funding.

The following universities were named regional UTCs: Massachusetts Institute of Technology (region 1), City University of New York (region 2), Pennsylvania State University (region 3), University of Tennessee (region 4), Purdue University (region 5), Texas A&M University (region 6), University of Nebraska (region 7), North Dakota State University (region 8), University of California (region 9), and University of Washington (region 10).

The UTC program was initiated in 1987 with the mission "to advance U.S. technology and expertise in the many disciplines comprising transportation through the mechanisms of education, research, and technology transfer at university-based centers of excellence." UTCs are expected to work collaboratively with USDOT and to provide leadership in making national and regional contributions to solving immediate and long-range transportation challenges.

TRB

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## Mary E. Peters Appointed USDOT Secretary

On September 30, 2006, the U.S. Senate confirmed former Federal Highway Administrator Mary E. Peters as the 15<sup>th</sup> U.S. Secretary of Transportation. Her new responsibilities include maintaining a safe, reliable, and efficient transportation system, while leading an agency with almost 60,000 employees and a \$61.6 billion budget that oversees air, maritime, and surface transportation missions.

Secretary Peters brings a unique perspective to her role as the Nation's Transportation Secretary, having spent her career working on transportation issues in the private and public sectors, including leading both Federal and State transportation agencies. Over her 20-plus years in transportation, Secretary Peters earned a reputation as an innovative problem solver, a force for safety, and a strong advocate for effective use of taxpayer dollars. As the Transportation Secretary, she intends to fight congestion across all modes of transportation, improve safety, and address strains on traditional sources of transportation funding.

In 2001, President George W. Bush asked Peters to lead FHWA. As FHWA Administrator from 2001 to 2005, she placed special emphasis on finding new ways to invest in road and bridge construction, including innovative public-private partnerships that help build roads faster and at less expense. She also was a strong advocate for using new technology to reduce construction time, saving taxpayer money and resulting in safer, longer lasting roads and highways.

## Policy and Legislation

### New "Stars on Cars" Rule Helps Consumers Evaluate Safety

Manufacturers will now display the Government's star safety ratings on every new vehicle with a price sticker, according to a new Federal rule. Administrator Nicole Nason of the National Highway Traffic Safety Administration (NHTSA) and Ohio Senator Mike DeWine announced the rule in Washington, DC, on September 7, 2006. The rule calls for an expanded window sticker to inform consumers of the safety ratings of new vehicles.

The rule requires that window stickers on new cars display NHTSA's star safety rating beginning with the 2008 model year. Consumers will be able to measure the safety information by the number of stars on the sticker. The new vehicle price stickers will contain NHTSA safety ratings in three areas—front and side crash and nondestructive rollover tests. All three tests use the five-star rating, with five stars being the safest.

"Senator DeWine, a strong advocate for highway safety, has done a great service for consumers by demanding that vehicle safety information be included on the sticker," says Administrator Nason. "By making safety a selling point, it is my hope that this rule will encourage...faster development of these kinds of technologies."

*NHTSA safety ratings can be seen at [www.nhtsa.dot.gov/ncap](http://www.nhtsa.dot.gov/ncap). The "Stars on Cars" requirements are available at [www.nhtsa.dot.gov](http://www.nhtsa.dot.gov).*

## Technical News

### FHWA's Enhanced Night Visibility Reports Now Available

FHWA's Visibility Research Program works to enhance safety by studying new, cost-effective practices and technologies to improve visibility along roadways.

The program recently completed a multiyear effort known as the Enhanced Night Visibility (ENV) project. To date, FHWA has released 16 of the planned 18 volumes in a series of reports documenting the ENV project. Some of the issues covered in the reports include visual performance during nighttime driving in clear weather, rain, and snow; evaluation of discomfort glare during nighttime driving in clear weather; the influence of headlight beam characteristics on discomfort and disability glare; detection of pavement markings during nighttime driving in clear weather; comparison of near infrared, far infrared, high-intensity discharge, and halogen headlamps on object detection in nighttime clear weather and rain; and characterization of experimental vision enhancement systems.

*For more information, visit [www.tfhrc.gov/safety/hsis/pubs/envseries.htm](http://www.tfhrc.gov/safety/hsis/pubs/envseries.htm).*

### MoDOT Selected to Test Hybrid Bucket Trucks

The Missouri Department of Transportation (MoDOT) is the first government agency in the Nation to test a new



Cathy Morrison, MoDOT photographer

MoDOT Director Pete Rahn is shown here demonstrating a new energy-saving, environmentally friendly, diesel-electric bucket truck.



energy-saving, environmentally friendly, diesel-electric bucket truck. MoDOT expects the Utility Hybrid Truck Pilot Program to demonstrate the vehicle's ability to cut fuel costs and smog-producing emissions in half, while also reducing maintenance costs, minimizing noise, and providing an alternative power source during emergencies.

Highway departments use bucket trucks to lift maintenance workers in the air to install signs, fix traffic signals, or replace streetlights. A conventional truck must remain running at a work site to operate the hydraulic arm that moves the bucket. New technology, however, enables workers to shut off the hybrid truck's engine at the work site, which significantly reduces emissions and saves fuel. With biodiesel fuel costing an average of \$2.45 per gallon (as of November 2006) in Missouri, MoDOT could potentially save \$2,665 per year per vehicle by replacing conventional trucks with hybrids. Statewide, MoDOT's fleet contains 106 conventional bucket trucks.

"We look forward to learning more about how these vehicles will compare to the conventional trucks in our fleet and how they can help us make the best use of taxpayer dollars," says MoDOT Director Pete Rahn.

MoDOT is field testing the hybrids for 18 months at district offices in Joplin, Kansas City, and St. Louis, placing the hybrid trucks in service along with comparably sized conventional trucks to assess performance, reliability, and business benefits. The hybrids and baseline conventional trucks are equipped with monitoring devices to compare the emissions and fuel economy of each type of truck.

*MoDOT*

## Public Information and Information Exchange

### USDOT Offers T3 Webinar on ITS Decisionmakers' Resources

What are the benefits of intelligent transportation systems (ITS) applications? What are the costs? What are the lessons learned in deploying these applications? Online resources are available to help answer questions like these. Sponsored by USDOT's ITS Joint Program Office and ITS Professional Capacity Building Program, an online Talking Technology and Transportation (T3) session shows ITS professionals how to use databases to answer these questions.

The T3 session, titled ITS Decisionmakers' Resources, shows participants how to use databases and other resources available from the ITS Applications Overview ([www.itsoverview.its.dot.gov](http://www.itsoverview.its.dot.gov)). The T3 seminar provides a Web-based tour of the ITS Benefits Database ([www.itsbenefits.its.dot.gov](http://www.itsbenefits.its.dot.gov)), the ITS Costs Database ([www.itscosts.its.dot.gov](http://www.itscosts.its.dot.gov)), ITS Deployment Statistics Database ([www.itsdeployment.its.dot.gov](http://www.itsdeployment.its.dot.gov)), and the ITS Lessons Learned Knowledge Resource ([www.itslessons.its.dot.gov](http://www.itslessons.its.dot.gov)).

The session involves a conference call and simultaneous webcast hosted by Joe Peters of the ITS Joint Program Office, and features presentations by Rob Maccubbin, Barbara Staples, Steve Gordon, and Firoz

Kabir. A scripted introductory session is followed by a "live" demonstration of the Web sites in which presenters respond in real time to questions from participants. The session is free of charge and is available to both Federal and non-Federal personnel by registering online at [www.pcb.its.dot.gov/T3/form\\_reg.asp](http://www.pcb.its.dot.gov/T3/form_reg.asp).

*If you have questions, please contact Craig Austin of the PCB Program at 617-494-3440 or [T3@volpe.dot.gov](mailto:T3@volpe.dot.gov).*

### ITS Applications Report Now Available

Older adults, people with disabilities, and individuals with lower incomes often experience challenges accessing transportation services such as public transit. These populations need flexible yet dependable routes and schedules, readily available and reliable traveler and system information, a single fare payment method that is convenient and easy to use, and transportation that is safe and secure. ITS technology can help public transit providers meet these needs.

The Federal Transit Administration (FTA)'s Office of Mobility Innovation and the ITS Joint Program Office have recently released, in print and online, *ITS Applications for Coordinating and Improving Human Services Transportation: A Cross-Cutting Study*. The study examines in depth the use of ITS technologies to improve transportation operations and coordination, information dissemination, fare payment, and safety and security. Included are lessons learned and keys to success in all stages of evolution of ITS technologies: planning, design, implementation, and evaluation.

*For more information about the report, contact Michael Baltes of the FTA Office of Mobility Innovation at 202-366-2182 or [michael.baltes@dot.gov](mailto:michael.baltes@dot.gov), or Yebuda Gross of the ITS Joint Program Office at 202-366-1988 or [yebuda.gross@dot.gov](mailto:yebuda.gross@dot.gov). To order a free printed copy, contact Karen Facen of the FTA Office of Research, Demonstration, and Innovation at [karen.facen@dot.gov](mailto:karen.facen@dot.gov).*

### TRB Transportation Research Electronic Circular Reaches Century Mark

The Transportation Research Board's (TRB) Electronic Circular series has posted its 100<sup>th</sup> title to the TRB Web site. The series, which started in 1998, is generated by TRB's Technical Activities Division committees with the guidance of senior program officers and other staff.

The 100<sup>th</sup> title, *Transportation Research Circular E-C100: Linking Transportation and Land Use: A Peer Exchange*, is the proceedings of a national land use peer exchange that took place July 12-13, 2005, in Boston, MA. The online report includes descriptions of ongoing land use activities, successes, new activities that agencies may be interested in pursuing, and obstacles to the successful coordination of land use and transportation activities.

Linking Transportation and Land Use: A Peer Exchange is available at <http://onlinepubs.trb.org/onlinepubs/circulars/ec100.pdf>.

*TRB*



This digital photo from a glass plate negative shows the Head Memorial Bridge in Greene County, IA. The digital version can be found at a new Iowa DOT Web site featuring hundreds of rare transportation-related images.

### History Preserved on Iowa DOT Web Site

Over the years, the Iowa Department of Transportation (Iowa DOT) has collected an eclectic mix of historic, transportation-related images. Now, electronic copies of more than 2,300 photographs and glass negatives, some dating back to the late 1800s, are available on Iowa DOT's Web site at [www.iowadot.gov/historic\\_photos](http://www.iowadot.gov/historic_photos).

Many of the images in Iowa's archival collection are one-of-a-kind and include photos of the early interstate system, snow removal, line painting, Iowa officials, early Iowa history, the Adopt-A-Highway program, Iowa DOT facilities, roads and streets, city streets and buildings, pipelines, bicycles, road building, the slipform paver, rivers, trains, horse-powered vehicles, vintage motor vehicles, the Lincoln Highway, aviation, interurban railroads, streetcars, and buses.

The mission of this project is to make these resources available to the public and to preserve the collection for future generations. The original physical archives (most are glass negatives) are extremely susceptible to damage from handling and remain inaccessible to the public. Therefore, the primary purpose of the Web site is to provide access to the images in the form of digitized copies. Due to the sheer volume of photos, only a limited number currently are offered on the Web. Additional images will be added as resources permit.

Visitors to the site will be able to select thumbnail images to be moved to a "lightbox" (similar to a shopping cart on a retail site) to be examined further and/or downloaded. Images can be downloaded for noncommercial use without obtaining permission. To use any images commercially, permission must be obtained in writing from Iowa DOT officials.

*Iowa DOT*

### MaineDOT Honored for Memorial Bridge Campaign

On August 15, 2006, the American Association of State Highway and Transportation Officials awarded the

Maine Department of Transportation (MaineDOT) a National Transportation Public Affairs Skills Award for "overall excellence in a public affairs campaign." The EXCEL Award was presented for MaineDOT's public education campaign on a 3-month closure of the Augusta Memorial Bridge.

According to MaineDOT Commissioner David Cole, "We are learning that larger, more complex infrastructure projects can be done faster, better, and certainly more cost-effectively if we use full, rather than partial, closures. However, full closures can be successful only if the public is informed."

Judges for the competition noted, "This was an outstanding program for a reasonable budget with a good mix of strategic thinking, community relations, and creative development." The campaign included radio spots, print ads, email alerts, and ongoing interaction with community leaders, major employers, downtown businesses, and the media.

*MaineDOT*

### American Safety Council Releases First Online Advanced Driver Improvement Course

The American Safety Council recently released the Nation's first online Advanced Driver Improvement (ADI) course, which has been approved by the Florida Department of Highway Safety and Motor Vehicles. The 12-hour course is required for Florida drivers whose driving privileges have been suspended due to excessive points, court order, or habitual traffic offenses (non-Driving-Under-Influence-related). The course assists drivers in developing alternative driving behaviors to those that resulted in their driving-privilege suspension or revocation. Participants are taught through various techniques to accept responsibility for their actions, understand and identify the consequences of continued poor driving, and develop a plan to avoid future difficulties.

To apply for a hardship license and restore driving privileges in Florida, drivers are required to enroll in a 12-hour ADI course. When students enroll online, they are immediately sent enrollment letters, which in most cases can be used to apply for their hardship license. Then, when drivers successfully complete the course, most are eligible for the full reinstatement of driving privileges. Course completion certificates are mailed to students automatically when the course is successfully completed.

"Bringing ADI school online lets Florida drivers capitalize on cutting-edge technology that provides innovative education and has proven to be very effective," says Bob Proechel, president of the American Safety Council. "Not only is a 12-hour course easier to retain in shorter increments, but also it enables people to take the class without transportation or childcare costs. Plus, there is no faster way to get back your enrollment letter, and ultimately, your license."

*The course is available online statewide through the American Safety Council's Web site at [www.ADISchool](http://www.ADISchool)*



.com. For additional information, please contact the American Safety Council at 1-800-732-4135.

*American Safety Council*

### **NHTSA Releases 2005 Traffic Fatality Counts and Injury Estimates**

NHTSA recently released 2005 fatality statistics for motor vehicle crashes. According to NHTSA, the total number of fatalities rose 1.4 percent from 42,836 in 2004 to 43,443 in 2005, while the rate of fatalities was 1.47 fatalities per 100 million vehicle miles traveled, up from 1.45 in 2004. The new data suggest that the increase in vehicle fatalities comes from the rise in the number of motorcycle fatalities and increases in the number of pedestrian fatalities over the previous year.

Motorcycle fatalities rose 13 percent from 4,028 in 2004 to 4,553 in 2005. Almost half of the people who died were not wearing helmets. The number of pedestrian fatalities increased to 4,881 in 2005 from 4,675 in 2004. NHTSA is investigating the increase in pedestrian fatalities in 2005 to determine the causes.

*The report, Motor Vehicle Traffic Crash Fatality Counts and Estimates of People Injured for 2005, is available online at [www-nrd.nhtsa.dot.gov/pdf/nrd-30/ncsa/ppt/2006/810639.pdf](http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/ncsa/ppt/2006/810639.pdf).*

### **New Jersey Governor Unveils \$74 Million Pedestrian Safety Initiative**

On September 18, 2006, Governor Jon Corzine announced the creation of a 5-year, \$74 million initiative to improve pedestrian safety throughout New Jersey. The New Jersey Department of Transportation (NJDOT), Department of Law & Public Safety, and Motor Vehicle Commission will implement a three-pronged strategy to encourage motorists to share the road with pedestrians.

"This initiative is designed to improve New Jersey's driving culture and enhance pedestrian education so we can increase the safety of our streets," says Governor Corzine. "Investing in engineering improvements, enforcing pedestrian safety laws, and changing the way we educate drivers will help ensure that our communities are...safe [places] to walk."

The initiative addresses pedestrian awareness, driver behavior, and roadway conditions that amplify crash risks. The State will use the funding for projects to improve the safety of intersections and sidewalks, implement traffic mitigation measures, enhance education and enforcement efforts, and develop planning and technical guidance. The initiative is funded from existing money in the Transportation Trust Fund.

The \$74 million initiative includes the Pedestrian Safety Corridor Program, the Safe Routes to School Program, and the Safe Streets to Transit Program. It also promotes improvements in planning, enforcement of pedestrian safety laws, distribution of grants for enforcing pedestrian laws, establishment of a statewide task force on traffic safety, development of a statewide driver education curriculum, and incorporation of pedestrian safety laws into the Motor Vehicle Commission's tests.

*NJDOT*

## **Personnel**

### **Nottingham Named Surface Transportation Board Chairman**

On August 14, 2006, the Surface Transportation Board (STB) announced that FHWA's Associate Administrator for Policy and Governmental Affairs Charles D. ("Chip") Nottingham was sworn in as its newest member and designated its new chairman by President George W. Bush.

Chairman Nottingham's oath of office was administered in the office of USDOT then-Acting Secretary Maria Cino in the presence of the current STB members, W. Douglas Buttrey and Francis P. Mulvey. As STB's fourth chairman, Nottingham will serve a term of office ending December 31, 2010.

Prior to joining STB, he served in the FHWA associate administrator position for 4 years. In 1999-2002, he served as chief executive officer of the Virginia Department of Transportation, where he managed a workforce of 10,500 and the third largest State-maintained highway system in the Nation. In 1995-1998, he served as counsel and chief of staff for Congressman Tom Davis and chief of staff for Congressman Bob Goodlatte. Prior to his appointment at FHWA in 2002, Nottingham served as counsel to the U.S. House of Representatives Committee on Government Reform.

In taking the oath of office, Nottingham said, "I am deeply honored to have been nominated by President Bush and confirmed by the U.S. Senate to serve as chairman of the STB. Our Nation's economic health and quality of life depend on our ability to improve our transportation infrastructure. I look forward to working at the STB and to addressing these infrastructure and other critical issues."

*STB*

### **Robert Sumwalt Named NTSB Vice Chairman**

Robert L. Sumwalt was sworn in as a member of the National Transportation Safety Board (NTSB) on August 21, 2006. His term of office will run until December 31, 2011. President George W. Bush also designated him as vice chairman of the NTSB for a 2-year term. Prior to coming to the NTSB, Sumwalt was manager of aviation for the SCANA® Corporation, an energy-based holding company.

Sumwalt was a pilot for 24 years with Piedmont Airlines, Inc., and then US Airways, logging more than 14,000 flight hours and earning type ratings in five aircraft before retiring from the airline in 2005. He has extensive experience as an airline captain, airline check airman, instructor pilot, and air safety representative.

A trained accident investigator, Sumwalt participated in the NTSB's investigation of the crash of USAir Flight 427 in 1994 near Aliquippa, PA, and the Transportation Safety Board of Canada's investigation of the crash involving Swissair Flight 111 off the coast of Nova Scotia in 1998. Sumwalt is a graduate of the University of South Carolina.

*TRB*

*By Kevin Monaghan*

## New NHI Course Meets NBIS Requirement for Divers Conducting Underwater Inspections

The latest update to the National Bridge Inspection Standards (NBIS) became effective January 13, 2005, and requires bridge inspection training for all divers conducting underwater inspections. One way to meet the requirement is satisfactory completion of a Federal Highway Administration (FHWA)-approved underwater bridge inspection training course. FHWA's National Highway Institute (NHI) has added a course to its offerings, Underwater Bridge Inspection (FHWA-NHI-130091).

The course provides an overview of inspection methods useful to personnel responsible for managing and conducting underwater bridge inspections. Topics include methods of underwater inspection, inspection techniques for underwater materials and scour, and underwater element-level condition rating. Practical exercises and demonstrations are used to reinforce the course content.

Upon completion of the course, participants will be able to do the following:

- Describe typical underwater defects and deterioration, and identify conditions contributing to rates of deterioration
- Identify inspection equipment and the advantages and limitations of each
- Identify procedures for planning and performing thorough and safe underwater bridge inspections
- Assign component and element-level condition ratings for underwater components in accordance with NBIS and agency requirements

The 3-day course targets experienced divers, as well as bridge inspection program managers, structural engineers, and nondiver bridge inspectors from the public and private sectors. There are no prerequisites.

NHI also offers several structure and bridge inspection-related courses. The following are some of the NHI courses available. Please visit [www.nhi.fhwa.dot.gov](http://www.nhi.fhwa.dot.gov) for more detailed information.

- Bridge Inspection Refresher Training (FHWA-NHI-130053)—The major goals of this course are to refresh the skills of practicing bridge inspectors in visual inspection techniques and to review inspectors' professional obligations. Participants also will discuss issues of national significance relating to the Nation's bridge infrastructure. By the course's end, attendees will be able to perform safety inspections, component or element-level condition ratings, functional appraisals, and data collection. They also will be able to evaluate channel scour as applied to



Collins Engineers, Inc.

**In NHI's Underwater Bridge Inspection course, attendees participate in an exercise demonstrating the practical application of tactile inspection techniques.**

waterway ratings and collect field data with precision.

- Engineering Concepts for Bridge Inspectors (FHWA-NHI-130054)—This course prepares technicians for NHI's more intensive 2-week course in bridge inspection, Safety Inspection of In-Service Bridges (FHWA-NHI-130055). It provides participants with conceptual knowledge of bridge engineering, including materials, material properties, bridge components and details, loadings, stresses and strains, and deterioration of bridge materials and members.
- Safety Inspection of In-Service Bridges (FHWA-NHI-130055)—This course fulfills NBIS requirements for comprehensive training. Participants will be administered mid-term and final examinations on the course, which is based on the new *Bridge Inspector's Reference Manual*. At the end of the course, attendees will be able to evaluate a variety of bridges and critical areas, review plans and reports before inspections, provide reports on defects, and identify equipment needed for inspections.
- Fracture Critical Inspection Techniques for Steel Bridges (FHWA-NHI-130078)—This course includes training and hands-on workshops for popular types of nondestructive testing (NDT) equipment and a case study for preparing an inspection plan for a fracture critical bridge. By the course's end, participants will know how to identify fracture critical bridges and members, perform a thorough fracture-critical member inspection, identify various crack types and assess their impact on performance, and recommend a necessary action based on inspection findings.
- Bridge Coatings Inspection (FHWA-NHI-130079)—During the course, participants will focus on inspection of surface preparation and application of protective coating systems for bridge and highway structures,



including navigation through the State's painting specification. At the end of the course, participants will understand coating specifications and how to diagnose premature coating failures. The course includes lectures, discussion, demonstrations, and hands-on workshops.

- **Inspection and Maintenance of Ancillary Highway Structures (FHWA-NHI-130087)**—Participants will learn how to establish and conduct an inspection program according to FHWA's "Guidelines for the Installation, Inspection, Maintenance, and Repair of Structural Supports for Highway Signs, Luminaries, and Traffic Signals." After completing the course, participants will be able to identify common visible weld defects, appropriate NDT techniques, factors that lead to corrosion, and repair techniques, as well as explain mitigation methods used in ancillary structures.
- **Bridge Construction Inspection (FHWA-NHI-130088)**—This core course establishes minimum competencies

among inspectors. Participants will gain knowledge of construction, the problems and consequences that can arise during construction, and how these factors affect a structure's safety and service life. Participants will interpret drawings and specifications; describe the construction sequence for various bridge systems, types, and materials; maintain bridge controls for location and elevation; perform surveys; and check dimensions.

*For more information on these courses, contact Gary Moss at 202-366-4654 or [gary.moss@fhwa.dot.gov](mailto:gary.moss@fhwa.dot.gov). To schedule a course, contact the NHI Training Coordinator at 703-235-0534 or [nbitraining@dot.gov](mailto:nbitraining@dot.gov). To obtain information about all NHI courses, access the course catalog at [www.nhi.fhwa.dot.gov](http://www.nhi.fhwa.dot.gov) or contact NHI at 703-235-0500 (phone) or 703-235-0593 (fax).*

**Kevin Monaghan** is a contractor for NHI.

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Martha M. Soneira, Editor-in-Chief. Date: October 11, 2006

# Internet Watch

by Mike Burk

## Expanded CoP Web Site Encourages Knowledge Sharing on Highway Topics

Business cultures are changing rapidly to take advantage of new technologies. Today, the concept of knowledge sharing through new interactive online tools is taking hold in more and more public and private organizations. As collaboration becomes a central concept in workplace culture, several State transportation agencies, such as the Virginia Department of Transportation, are beginning to implement or investigate knowledge sharing tools and practices in their daily operations.

Since 1998 when the Federal Highway Administration's (FHWA) first online "Community of Practice (CoP)" was launched, FHWA has become a leader in knowledge management and use of online communities to share knowledge in the transportation community. Most recently, FHWA's efforts were recognized as a "Top 20" initiative in the 2006 IAC Collaboration and Transformation SIG's Excellence.gov awards and as a "Best-Practice Partner" in 2005 by the American Productivity and Quality Consortium. Currently FHWA operates more than 30 online communities addressing 250 topics.

### Online Community

The Web site, <http://knowledge.fhwa.dot.gov>, is a gateway to online internal FHWA and external CoPs. In contrast to typical Web sites, which provide one-way information delivery, CoPs provide a "home base" on key topics where people can discuss, share, network, and learn. These Web-based tools are designed to facilitate knowledge exchange and promote workforce development within the highway community. Each CoP offers users a range of tools to share knowledge and gain insight regarding a particular issue of concern to the highway community. FHWA CoPs cover a wide range of topic areas including Alternative Contracting, National Highway Visibility, Value Pricing, National Environmental Policy Act (NEPA) Process and Documentation, Environmental Streamlining and Stewardship, and Work Zones.

These online communities bring together stakeholders from across the highway community, including FHWA staff members and staff from other Federal agencies, State and local governments, municipal planning organizations, research entities, industry, academia, and nonprofit organizations. For example, the *Re:NEPA* community engages this broad set of stakeholders in an open exchange of knowledge, information, experience, and ideas about NEPA, related environmental issues, and transportation decisionmaking. As a result, the highway community can explore the transportation decisionmaking process through discussion, research, assistance, and education that is directed toward a better, streamlined, and solution-oriented process for balancing transportation needs and the social, economic, cultural, and natural environment.

Peter U. Eun, a safety engineer with the FHWA Resource Center Safety and Highway Design Technical Service Team, is a regular user of the internal, FHWA-only

"Safety Exchange" CoP. "[The site enables users] to find the answers...they were looking for," says Eun. "The site will help people do their jobs better and more efficiently. The ultimate goal is for people to get the information they need and apply it to help save lives."

### A Successful Collaboration

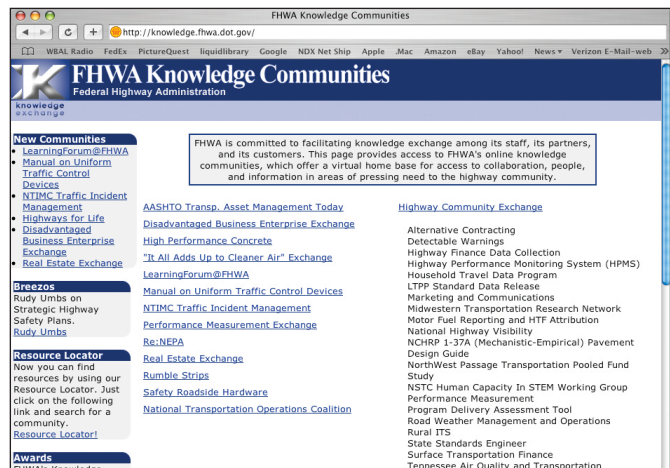
The communities offer discussion areas where users can post questions, ideas, and comments and respond to posts from others, creating an online dialogue. Users also have access to reference areas, where they can post and/or download relevant and useful information. Reference materials, both past and present, include policies, guidance, memos, articles, and photos. Event calendars offer a space for members to post upcoming events, and member directories serve as expertise locators to enable users to contact other individuals with expertise in a particular topic area.

"The discussion feature enables people to ask questions of their colleagues or make comments on a point/topic," says Eun. "But the Safety Exchange is an internal community—meaning only those within FHWA have access. Thus discussions can be open and honest."

FHWA currently is implementing additional functions. The site will adopt a new tool for knowledge sharing called "Knowledge On-Demand," a set of online, multimedia presentations from FHWA staff on key technical and program topics.

"I think the on-demand access to a group of experienced practitioners with similar interests is one of the most useful parts of the site," says Lamar Smith, team leader of the Training, Technical Assistance, and Technology team in FHWA's Office of Project Development and Environmental Review. "The site also offers easy-to-use question formats, engaging discussions, informative searches, and daily notices of new information posted, and it is updated routinely."

*For more information, contact FHWA Chief Knowledge Officer Mike Burk of the Office of Professional and Corporate Development at 202-366-8035 or [mburk@dot.gov](mailto:mburk@dot.gov).*



FHWA's "CoP" Web site is shown here.



# Communication Product Updates

*Compiled by Zac Ellis of FHWA's Office of Research and Technology Services*

*Below are brief descriptions of products recently published online by the Federal Highway Administration's (FHWA) Office of Research, Development, and Technology. Some of the publications also may be available from the National Technical Information Service (NTIS). In some cases, limited copies are available from the Research and Technology (R&T) Product Distribution Center.*

*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](http://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**  
**5285 Port Royal Road**  
**Springfield, VA 22161**  
**Telephone: 703-605-6000**  
**Toll-free number: 800-553-NTIS (6847)**

*Address requests for items available from the R&T Product Distribution Center to:*

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**Federal Highway Administration**  
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**Lanham, MD 20706**  
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**Fax: 301-577-1421**

*For more information on research and technology publications from FHWA, visit the Turner-Fairbank Highway Research Center's (TFHRC) Web site at [www.tfhrc.gov](http://www.tfhrc.gov), FHWA's Web site at [www.fhwa.dot.gov](http://www.fhwa.dot.gov), the National Transportation Library's Web site at <http://ntl.bts.gov>, or the OneDOT information network at <http://dotlibrary.dot.gov>.*

**Pedestrian Access to Roundabouts:  
Assessment of Motorists' Yielding to  
Visually Impaired Pedestrians and Potential  
Treatments to Improve Access**  
**Publication No. FHWA-HRT-05-080**

This report describes two related studies intended to address double-lane roundabout accessibility issues for visually impaired pedestrians. The first study was conducted on a closed course to evaluate a pavement treatment for alerting visually impaired pedestrians when vehicles have yielded to them. The second study examined drivers' yielding behavior at a two-lane roundabout and the effectiveness of the same roadway treatment in a real-world environment.

In the first study, there were two experimental conditions: a control condition and a treatment condi-

tion in which rumble strip-like devices were placed on the roadway surface. Seven people who have severe visual impairments participated. Participants stood at a crosswalk and used hand signals to indicate when they detected vehicles stopping or departing after a stop. Compared to the control condition, the "sound strips" treatment increased the probability of detecting stopped vehicles and decreased by more than 1 second the amount of time needed to make a detection. However, the treatment did not reduce the number of false detections that could result in the pedestrian crossing when moving vehicles are approaching the crosswalk.

The second study was an experiment at an operating roundabout. In that environment, the sound strips were not effective, probably because the majority of vehicles stopped in the circular roadway before crossing over the rumble strips. A "Yield to Pedestrians, State Law" sign that was placed in the roundabout exit between the two travel lanes resulted in more drivers yielding, from 11 percent of vehicles in the control condition to 16 percent in the experimental condition. Researchers concluded that the treatments explored in these studies do not appear promising for double-lane roundabouts, but should be explored further to see if they might work at single-lane crossings.

This document is available online at [www.tfhrc.gov/safety/pedbike/pubs/05080/alttext.htm](http://www.tfhrc.gov/safety/pedbike/pubs/05080/alttext.htm).

**Interim Recommendations for the Use of Lithium To Mitigate or Prevent Alkali-Silica Reaction (ASR)**  
**Publication No. FHWA-HRT-06-073**

Alkali-silica reaction (ASR) is a significant durability problem that has resulted in premature deterioration of various types of concrete structures in the United States and throughout the world. Although several viable methods exist to prevent ASR-induced damage in new concrete structures, very few methods mitigate further damage in structures already affected by ASR-induced expansion and cracking. Lithium compounds have been recognized for more than 50 years as effectively preventing expansion caused by ASR, and there has been renewed interest in recent years in using lithium compounds as either an admixture in new concrete or as a treatment of existing structures. This report is intended to provide practitioners with the necessary information and guidance to test, specify, and use lithium compounds in new concrete construction, as well as to use it in repair and service life extension applications. This report replaces the previous report, *Guidelines for the Use of Lithium to Mitigate or Prevent*



ASR, and includes significant changes related to recommendations for testing and specifying lithium compounds.

This report provides a basic overview of ASR, including information on mechanisms, symptoms of ASR damage in field structures, mitigation approaches, test methods, and specifications. A comprehensive summary of lithium compounds is provided, including information on their production, availability, and use in laboratory concrete studies and field applications. Guidelines for using lithium compounds as an admixture in new concrete and for treating existing structures suffering from ASR-induced damage are presented, including information on how to assess the efficacy of lithium compounds in laboratory tests. Some basic information also is provided on the economics of using lithium both in new concrete and as a treatment for existing structures. A summary of conclusions is included and identifies several technical and practical issues that should be considered for future laboratory studies and field operations.

#### **Job Site Evaluation of Corrosion-Resistant Alloys For Use as Reinforcement in Concrete** **Publication No. FHWA-HRT-06-078**

Premature deterioration of the Nation's concrete highway and bridge structures because of chloride (salt) exposure and resultant corrosion of reinforcing steel has evolved during the past four decades to become a formidable technological and economic problem. In response to this, epoxy-coated reinforcing steel (ECR) was adapted in the mid-1970s as a proactive measure to control this problem. Premature corrosion-induced cracking of marine bridge substructures in Florida indicated, however, that ECR is of little benefit for this type of exposure; and although performance of ECR in northern bridge decks has been generally good to date (30-plus years), the degree of corrosion resistance to be afforded in the long term to major structures with design lives of 75–100 years is uncertain. Corrosion-resistant reinforcements, including stainless steels, are an alternative for such applications and are a component of the FHWA Innovative Bridge Research and Construction (IBRC) Program. IBRC has addressed the incorporation of such reinforcements into approved State bridge construction projects. The present project evaluated a selected number of these in terms of the type of reinforcement used and difficulties and advantages that were encountered.

The various State projects demonstrated that, subject to availability, corrosion-resistant reinforcing steel can be incorporated into bridge construction with relative ease and placed with less difficulty than ECR. Thus, these reinforcements are a viable technical alternative to ECR. Realizing the full benefit of the IBRC program, however, will depend upon individual States acquiring performance data and maintaining records on these structures for decades into the future.

This document is available online at [www.tfhrc.gov/structur/pubs/06078/index.htm](http://www.tfhrc.gov/structur/pubs/06078/index.htm).

#### **Identifying Incompatible Combinations of Concrete Materials: Volume I—Final Report** **Publication No. FHWA-HRT-06-079**

Several test methods have been reviewed to assess their usefulness in detecting concrete material incompatibility early to help prevent problems with pavements in the field. A protocol has been developed to enable product manufacturers, concrete producers, contractors, and owners to monitor their materials and concrete systems.

The protocol is phased to allow relatively simple field tests for providing early warnings of potential problems and then central laboratory tests for supporting and confirming the field work.

This is the first of two volumes. The other volume in this series is *Identifying Incompatible Combinations of Concrete Materials: Volume II—Test Protocol* (FHWA-HRT-06-080).

#### **Identifying Incompatible Combinations of Concrete Materials: Volume II—Test Protocol** **Publication No. FHWA-HRT-06-080**

Unexpected interactions between otherwise acceptable ingredients in portland cement concrete are becoming increasingly common as cementitious systems become more complex and demands on the systems are more rigorous. Examples of incompatibilities are early stiffening or excessive retardation, potential for uncontrolled early-age cracking, and unstable or unacceptable air void systems. Several test methods have been reviewed to assess their usefulness in early detection of incompatibility, and thus to prevent pavement problems in the field. A protocol has been developed to enable product manufacturers, concrete producers, contractors, and owners to monitor materials and concrete systems. The protocol has two phases: relatively simple field tests to provide early warnings of potential problems and central laboratory tests to support and confirm the field work.





This is the second of two volumes. The other volume in this series is *Identifying Incompatible Combinations of Concrete Materials: Volume I—Final Report* (FHWA-HRT-06-079).

### Protocol to Identify Incompatible Combinations Of Concrete Materials (TechBrief)

Publication No. FHWA-HRT-06-082

For this project, “incompatibility” of concrete materials is defined as interactions between acceptable materials that result in unexpected or unacceptable performance. The most common problems are associated with premature stiffening (rapid slump loss), erratic setting of concrete mixtures (flash set, false set, or delayed setting and strength gain), and increased risk of cracking and unacceptable air void systems. Proper consolidation, finishing, texturing, and curing also can be disrupted.

The aim of this project was to develop a protocol that enables users to assess whether a given combination of materials used to make concrete for pavements is likely to exhibit such incompatibility in a given environment.

The TechBrief is available online at [www.fhwa.dot.gov/pavement/concrete/06082](http://www.fhwa.dot.gov/pavement/concrete/06082).

### Intelligent Intersection Traffic Control Laboratory Fact Sheet

Publication No. FHWA-HRT-06-102

The Intelligent Intersection Traffic Control Laboratory (IITCL) is an outdoor facility that supports various research programs and research activities conducted by FHWA and other U.S. Department of Transportation

(USDOT) agencies. This includes USDOT’s two major intelligent transportation system programs: the Cooperative Intersection Collision Avoidance Systems initiative and the Vehicle Infrastructure Integration initiative. IITCL serves as a testing ground for intersection-related research projects and as a place to integrate and demonstrate advanced technologies. Since its inception, many successful demonstrations and research activities have been conducted there.

The fact sheet is available online at [www.tfhrc.gov/about/06102.pdf](http://www.tfhrc.gov/about/06102.pdf).

### Federal Outdoor Impact Laboratory Fact Sheet

Publication No. FHWA-HRT-06-107

The Federal Outdoor Impact Laboratory (FOIL) is a fully equipped outdoor crash testing laboratory and research facility used to support FHWA’s Office of Safety Research and Development programs and other federally funded security initiatives. Researchers use the facility to extend their understanding of crashes by staging controlled, high-speed motor vehicle collisions. The facility typically is used to confirm the accuracy of computer-generated crash predictions. This ensures that tested roadside structures—structures that typically are located in close proximity to the Nation’s roadways—function as intended when struck by a motor vehicle. Routine certification or compliance testing of roadside safety structures, including testing performed to ensure compliance with existing safety standards, is not conducted at FOIL.

The fact sheet is available online at [www.tfhrc.gov/about/foil.htm](http://www.tfhrc.gov/about/foil.htm).

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# Conferences/Special Events Calendar

| Date                   | Conference                                                                                                    | Sponsor                                                                                                                                                                                                                                                                                                     | Location          | Contact                                                                                                                                                |
|------------------------|---------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| April 14-18, 2007      | American Planning Association Annual National Planning Conference                                             | American Planning Association                                                                                                                                                                                                                                                                               | Philadelphia, PA  | American Planning Association<br>312-786-6397<br>conference@planning.org<br>www.planning.org/2007conference                                            |
| May 6-9, 2007          | 11 <sup>th</sup> Transportation Research Board (TRB) National Transportation Planning Applications Conference | Florida Department of Transportation (FDOT), Florida Metropolitan Planning Organization Advisory Council, Volusia County Metropolitan Planning Organization, McTrans Moving Technology, and FDOT Model Task Force                                                                                           | Daytona Beach, FL | Barbara Arens<br>313-963-4651<br>arens@pbworld.com<br>www.trb-appcon.org                                                                               |
| June 4-6, 2007         | 3 <sup>rd</sup> National/1 <sup>st</sup> International Conference on Performance Measurement                  | Federal Highway Administration (FHWA) and Federal Transit Administration                                                                                                                                                                                                                                    | Irvine, CA        | Martine Micozzi<br>202-334-3205<br>mmicozzi@nas.edu<br>http://trb.org/news/blurb_detail.asp?id=6236                                                    |
| June 24-27, 2007       | 9 <sup>th</sup> International Conference on Low-Volume Roads                                                  | TRB, U.S. Department of the Interior Bureau of Indian Affairs, FHWA, U.S. Department of Transportation, U.S. Department of Agriculture Forest Service, U.S. Army Corps of Engineers Engineer Research and Development Center, and U.S. Environmental Protection Agency (EPA)                                | Austin, TX        | G.P. Jayaprakash<br>Michael DeCarminc<br>202-334-2952<br>trbmeetings@nas.edu<br>9lvr@nas.edu<br>www.trb.org/conferences/9lvr                           |
| July 8-11, 2007        | Pipelines 2007                                                                                                | American Society of Civil Engineers (ASCE)                                                                                                                                                                                                                                                                  | Boston, MA        | Leonore Jordan<br>800-548-2723<br>ljordan@asce.org<br>http://content.asce.org/conferences/pipelines2007                                                |
| July 9-11, 2007        | Transportation Land-Use, Planning, and Air Quality Conference 2007                                            | FHWA, TRB, ASCE, EPA, Air & Waste Management Association, Georgia Institute of Technology, Center for Transportation Research and Education at Iowa State University, TRB Committee on Transportation and Air Quality, and ASCE's Transportation and Development Institute Planning and Economics Committee | Orlando, FL       | Robert O'Loughlin<br>415-744-3828<br>robert.o'loughlin@fhwa.dot.gov<br>www.ctre.iastate.edu/educweb/transaq/transaq2007.htm                            |
| July 29-August 2, 2007 | Subcommittee on Construction Annual Meeting                                                                   | American Association of State Highway and Transportation Officials                                                                                                                                                                                                                                          | Biloxi, MS        | Jim McDonnell<br>202-624-5448<br>jimm@ashto.org<br><br>Ruthann Vercher<br>601-359-7105<br>rvercher@mdot.state.ms.us<br>www.transportation.org/meetings |
| September 10-13, 2007  | 2007 Hydraulics Measurement & Experimental Methods Conference                                                 | Environmental and Water Resources Institute (EWRI) of ASCE and International Association of Hydraulic Engineering and Research                                                                                                                                                                              | Lake Placid, NY   | EWRI<br>703-295-6380<br>ewri@asce.org<br>http://content.asce.org/conferences/HMEM07/welcome.html                                                       |



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