Public Roads

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May/June 2006

Older Drivers' Safety
High-Payoff Research
Freight Goes High-Tech

U.S. Department of Transportation
Federal Highway Administration

Public Roads

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

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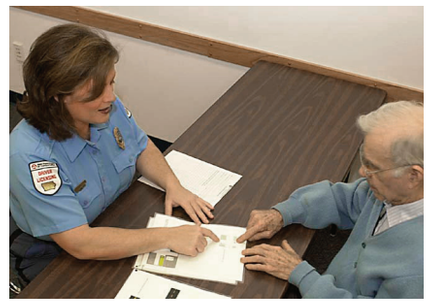
Articles



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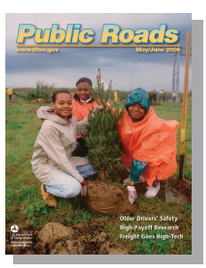

Front cover—The students on the cover of this issue are helping plant trees near a widened roadway. SAFETEA-LU includes funding for programs to introduce students of all ages to career opportunities in transportation, which not only include the traditional construction and engineering fields but also project management, finance, communications, environmental issues, and information technology. *Photo: FHWA.*

Back cover—Cameras like this one are part of a comprehensive automated traffic management system developed by the North Carolina Department of Transportation (NCDOT) to help mitigate congestion and improve responses to traffic incidents on I–77 near Charlotte. The project was NCDOT's first use of design-build-warrant contracting. *Photo: NCDOT.*

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Guest Editorial

Meeting the Freight Challenge

The United States moves an astounding quantity of goods. According to the Federal Highway Administration's (FHWA) Freight Analysis Framework, nearly 17 billion metric tons (19.5 billion tons) of freight worth approximately $13.1 trillion were moved in 2002, the year for which the most current and comprehensive data are available. This volume is a mix of domestic goods and a large and growing international trade that translates into 168 kilograms (370 pounds) of goods moved *daily* for each U.S. resident. The U.S. gross domestic product in 2002 was approximately $10 trillion, and 23 percent of it was attributable to international trade, reflecting unprecedented global connectivity. Forecasts indicate that freight volumes will continue to grow, particularly in international shipments.

The upside is that these volumes represent a robust and growing economy. The downside is that they are contributing to and being affected by capacity constraints and congestion in the transportation system. Traffic congestion imposes costs on shippers, consumers, and the environment. Given current and predicted constraints on physical capacity, finding ways to improve the efficiency of moving freight within the United States and to and from other nations is a significant challenge. It is one that must be met, however, because the efficient movement of goods is critical to the country's economic well-being.

None of the respective players has the tools—or the authority—to meet the challenge alone. Finding ways to move goods efficiently will involve the combined effort of all levels of government and the private sector. Pursuing such collaboration led the U.S. Department of Transportation (USDOT) to develop a Framework for a National Freight Policy.

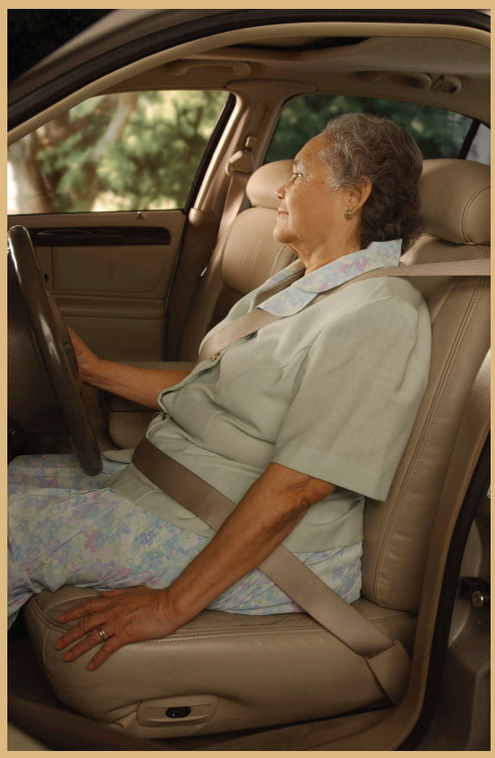
The framework for a national policy is composed of seven objectives, one of which is to improve operation of the existing freight transportation system. To better understand current and evolving freight operations and where opportunities for improvement exist, USDOT is working with a broad range of partners, including the Intermodal Freight Technology Working Group (IFTWG), a public-private partnership. A few years ago, IFTWG extensively mapped the physical movement of goods through various supply chains along with the associated information transfer.

Freight movement, particularly international shipping, involves a complex exchange of information between multiple entities (governmental and commercial) associated with the transfer of goods within and between modes of transportation. Following the mapping effort, IFTWG determined that the information transfer connected with the physical movement of goods is a critical juncture between operations and technology, where improvements in speed, accuracy, and visibility could bring significant gains in efficiency. The Electronic Freight Management (EFM) program is a direct result of that effort and specifically targets information exchange.

The EFM program is a USDOT-sponsored research effort in intelligent transportation systems that partners with freight-related industries to improve the efficiency, safety, and security of goods movement. The EFM program seeks to demonstrate the use of a common message set that enables electronic transfer of shipment information between supply chain partners and provides all partners with access to that information in real time. In what is a genuinely collaborative effort, EFM stakeholders include a Fortune 500 company and its supply partners in Asia and the United States. Government partners are USDOT, the Transportation Security Administration, and U.S. Customs and Border Protection.

The EFM program is emblematic of how working together can help meet the freight challenge. It marries industry and government priorities and objectives in a way that leverages collective experience, shared investment, and common effort.

Anthony T. Furst
Director, Office of Freight Management and Operations
Federal Highway Administration



Road Users *Can* Grow Old Gracefully—With Some Help

by Lisa Phillips, Gabriel Rousseau, and Joanne Schwartzberg, MD

When making recommendations on infrastructure design, FHWA considers changes in the abilities of senior motorists and pedestrians.

By the year 2030, one in five Americans will be age 65 or older. The fastest growing segment of the U.S. population is people more than 85 years of age. Every year, a growing portion of those who use the Nation's roads and sidewalks are older adults.

As people age, their abilities change. Some things, such as vocabulary and knowledge, can increase throughout a person's lifespan, but other abilities, such as vision, typically decline. Unfortunately, a large vocabulary does not help a motorist drive across town as much as acute visual ability does.

The challenge for the transportation industry is to maximize safe mobility options for the older population while maintaining safety for all road users. "Understanding how the most common age-related abilities decline can help the transportation community design infrastructure to minimize the negative consequences of those declines," says Elizabeth Alicandri, director of the Federal Highway Administration's (FHWA) Office of Safety Programs.

(Above) Older motorists like this woman will benefit from highway improvements such as improved intersections and larger street signs. *Photo: NHTSA.*

Challenges Associated With Decreased Abilities

The aging process is specific to each individual, although certain chronic medical conditions and associated functional limitations that can affect driving may become more prevalent with age. A particular medical diagnosis alone, however, does not guarantee functional decline in ability. Because of the diversity in how age affects different individuals, many older adults will continue to drive safely well into their retirement years.

"Many assume that all drivers become dangerous as they age," says Dennis Utter, director of the Office of Traffic Records and Analysis, National Center for Statistics and Analysis. "This possibility is a growing public health concern. On the one hand, the average annual driver involvement rate in police-reported motor vehicle crashes in the United States is 55 per 1,000 licensed drivers, while the corresponding rate for drivers aged 65 and older is only 28 per 1,000."

If measured by miles traveled, however, older adults may be at increased crash risk. According to National Highway Traffic Safety Administration (NHTSA) data from the mid-1990s, drivers aged 85 and older have about the same fatality rate per mile driven as 20- to 24-year-olds.

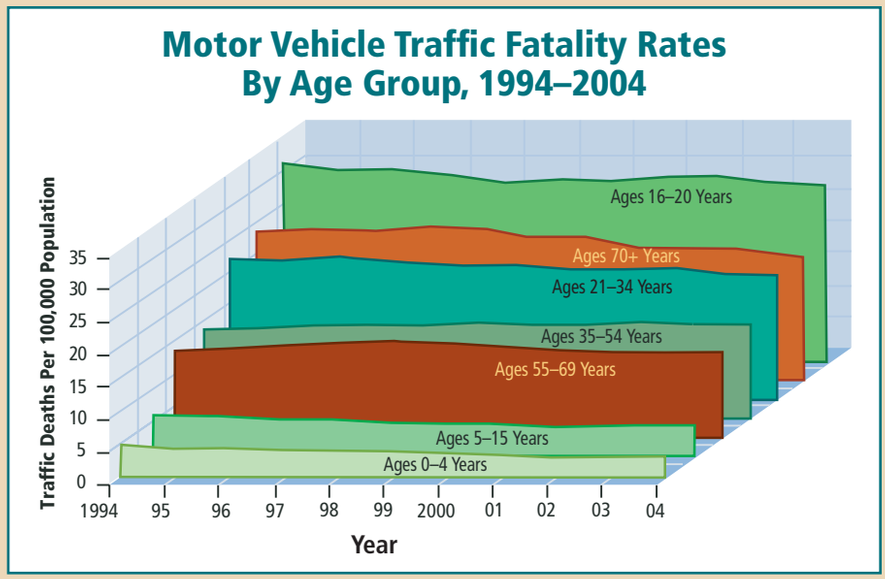
The primary issue is the potential for increased deaths of both older drivers and older pedestrians. Older drivers are less a threat to other road users than they are to themselves. However, crashes lead to death more frequently for older people, who may be frail due to chronic medical conditions and may take much longer to recover from severe injuries.

Moreover, travel options other than driving are extremely limited in many areas of the United States. Driving remains the preferred mode, particularly where reliable and affordable alternatives do not exist. Driving can help maintain the benefits of personal mobility for seniors, both physically and socially. Loss of personal mobility, on the other hand, can lead to cascading negative effects such as depression, which can then accelerate physical and mental deterioration, leading to earlier hospitalizations and nursing home admissions. For a majority of older Americans, driving is the only "personal" mobility option they have ever known, and they have come to expect to maintain the privilege indefinitely.

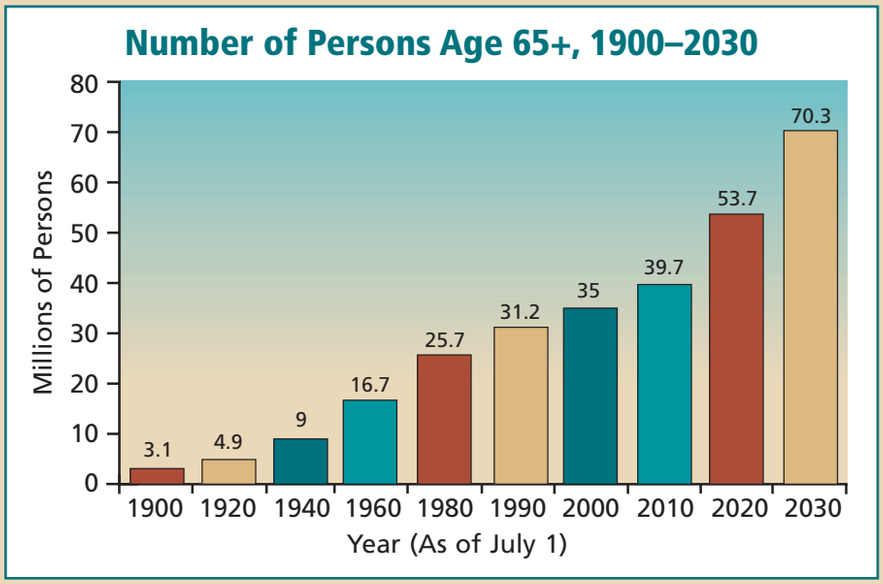
In many urban areas, walking can be an enjoyable and healthful travel option for older adults. In fact, after driving, walking is the second most used travel mode by older people. Walking often is not an option, however, for both real and perceived reasons. Older pedestrians are more vulnerable to death or serious injury when struck by motor vehicles, and older adults sometimes cite personal security as a reason for not walking.

Given the necessity of driving and walking for many older adults, reviewing facts about their habits can shed light on the challenges. Seniors actually practice many safe driving behaviors. They are more likely to wear seatbelts and obey the speed limit. They are less likely to engage in some of the risky behaviors more common to younger drivers, such as talking on a cell phone or drinking and driving. Once they become aware of changes in their physical abilities, older drivers often begin to self-regulate by limiting their driving at night, in unfamiliar areas, on roads with heavy traffic, in bad weather, or alone.

Older drivers do have a higher crash risk in some conditions and locations. According to the FHWA publication *Highway Design Handbook for Older Drivers and Pedestrians* (FHWA-RD-01-103), older drivers are more likely than other age groups to have crashes at intersections, when making left turns, and on limited access highways when merging, exiting, or changing lanes. Some common areas of difficulty include yielding, responding to signs and signals, scanning the roadway environment, staying in their lane, keeping up with the flow of traffic, passing, and stopping.



Source: NHTSA Traffic Safety Facts 2004.



Source: Administration on Aging.

Countermeasures for Common Conditions

What can be done to help older road users in the face of these changes in ability? According to a 2003 University of Michigan Transportation Research Institute report, *Promising Approaches for Enhancing Elder Mobility*, medical and transportation professionals agree that the focus of safety efforts should be on helping older drivers and pedestrians who are able to continue driving and walking safely to do so, rather than focusing on restricting all older drivers regardless of ability. The challenge is making roads safer and decreasing mortality while maintaining independence for older motorists and pedestrians. In other words, what can be done to plan for their transportation needs?

As mentioned earlier, aging is a highly individual process, and changes occur at different rates. After all, there are 80-year-olds who are more productive than many 18-year-olds. Some 70-year-olds look and act much younger than their years, whereas others already experiencing serious chronic illness feel and act even older. Still, a few functional impairments are more common than others. The focus in transportation planning is on

AAA Foundation for Traffic Safety

Older adults such as the driver and passenger in this car differ in the rates at which their driving abilities decline.

AAA Foundation for Traffic Safety

This older driver presumably checked her rearview mirror before backing out of her driveway. As people age, their peripheral vision and ability to shift focus from a near to a far object decline.

the changes that most people will experience and the ways that infrastructure can be designed to make mobility easier and safer for them.

Vision Changes and Improving Roadway Visibility

What actually happens to people's eyes as they age? Two of the key changes occur in the lens, which focuses light on the retina. The lens becomes less flexible and yellows with age. The reductions in flexibility make it harder to shift focus from a near object to a far object. In fact, presbyopia, or nearsightedness, is a common age-related visual change. The yellowing of the lens and other changes cause older adults to need more light to see. Although they benefit from additional lighting, they also are more susceptible to glare and require significantly more time to recover from it. One of the major consequences of these and other vision changes is that it is harder for older people to see at night.

Other changes occur as well, such as declines in peripheral vision. Because of these changes, older adults often are slower to react to objects outside of their central focus. Natural declines in peripheral vision often are made worse by glasses, which usually improve focal vision rather than vision in the entire visual field.

A number of infrastructure measures can reduce the impact of vision declines. One of the most obvious steps is to enlarge roadway signs and lettering. If drivers can read the information from farther away, they will have more time to make navigation decisions and can focus on safe maneuvers. The *Manual on Uniform Traffic Control Devices* (MUTCD) recommends sign and font sizes for various types of signs. According to Hari Kalla, FHWA's MUTCD program manager, "The 2003 edition of the MUTCD includes increased letter sizes for street signs based on research recommendations for older drivers."

Curves present another visual challenge. Older drivers may not detect sharp curves, especially at night and wherever the retroreflective pavement markers have faded. Declines in contrast sensitivity (the ability to discern brightness differences between adjacent areas) make it harder for older drivers to notice faded pavement markings, but those markings provide extremely important information to drivers under dark or rainy driving conditions.

One technique to improve curve detection for sharp curves is to use retroreflective pavement markings leading up to the curve and spaced throughout it. These pavement markings are highly visible at night, and researchers at FHWA's Turner-Fairbank Highway Research Center (TFHRC) are looking at configurations that will make it even easier for older drivers to detect sharp curves. Thomas M. Granda, Ph.D., team leader for the Human Centered Systems Team in FHWA's Office of Safety Research and Development, oversees the highway driving simulator at TFHRC. He says, "Our research team is using both the driving simulator and field research techniques

to determine the best configurations for retroreflective pavement markings to make curve detection easier for drivers of all ages. And we involve older adults in all of our pedestrian and driving research."

Musculoskeletal Function and Improving Intersections

People may move more slowly with age. Some older adults experience loss of limb strength, flexibility, sensitivity, and/or range of motion, or reduced ability to rotate the head and neck. Such changes may be the result of simple joint inflammation and deterioration (arthritis), muscle atrophy or paralysis related to stroke, or other problems. Chronic illnesses, such as coronary artery disease, heart failure, and emphysema, can greatly restrict and slow physical activity and mobility. General flexibility and head movements in particular are necessary to physically operate a motor vehicle, particularly for merging, lane positioning, and parking.

Reduced flexibility can affect a variety of driving tasks, especially where drivers have to visually scan a wide portion of the roadway environment. Some types of scanning cannot be eliminated, such as looking for other cars, pedestrians, or traffic signals, but it is important to avoid creating situations where excessive scanning is necessary. For example, consider skewed intersections where two roads meet at an angle that is less than 60 degrees instead of at a right angle. Because of their design, skewed intersections require more head movement and scanning. New highway projects should avoid skewed designs where possible. If a skewed intersection cannot be avoided, right turn on red should be prohibited because some older drivers will have a harder time detecting safe gaps in traffic.

The effects of age- and illness-related changes in flexibility on navigating skewed intersections are apparent. But physical difficulties may not seem relevant to providing advance guide and street signs. Advance information enables older drivers to ready themselves to make the appropriate responses, such as braking or turning. That small amount of extra time can make a difference. Advance signing enables drivers to focus on making a safe turn instead of having to look for a street sign at the same time.

Cognitive Changes And Making Roadway Navigation Easier

According to NHTSA's *Medical Conditions and Driving: A Review of the Literature (1960–2000)*, the source of the most commonly occurring traffic violations leading to increased crashes involving older drivers, such as failure to obey stop signs or unsafe left turns, is not an "obedience" problem but rather "attentional errors." Such errors may signal cognitive decline, which can develop from a number of conditions, such as the early stages of Alzheimer's disease. Cognitive abilities also may be affected by the interactions of various medications taken for a number of chronic conditions.

Working memory is the ability to maintain information active in memory. A classic example is learning a new phone number and trying to remember it until you can dial it. With age and illness, the working memory capacity—the amount of information that can be held in memory at one time—often declines. There are many different types of attention. Selective attention is used continuously to filter out extraneous sensory information in order to focus on critical information, though most people may be largely unaware that they are doing it. On the other hand, divided attention is used to monitor and respond to multiple events at the same time. An example is the combined tasks of entering a freeway while tracking the curvature of the ramp to steer appropriately and keeping a safe distance from the cars ahead. In general, older adults often find it harder to screen out unnecessary information, especially when they are in unfamiliar situations. They may encounter difficulties when performing multiple tasks at the same time.

Reaction time is the time from when a stimulus appears to when a physical response is initiated. The reduced muscular flexibility of older adults contributes to slower responses. One aspect of age-related slowing in reaction time is slower information processing in the brain. As a result, older drivers may be slower to react when a traffic signal turns from red to green or when applying the brakes during an emergency situation.

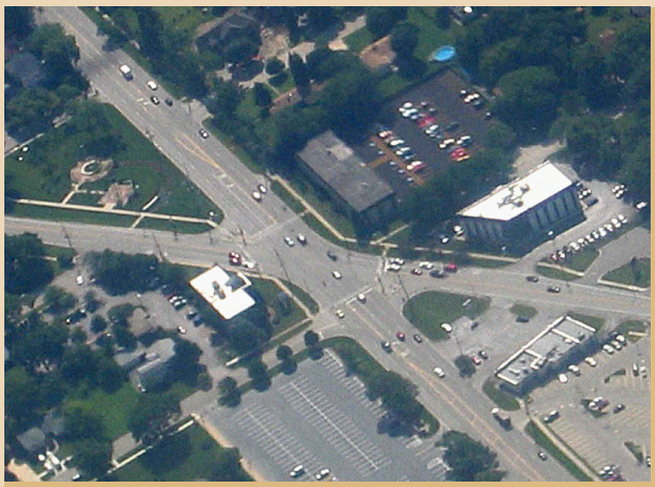
Redundant street name signs can be used to improve the chances of drivers remembering critical navigation information when they need it. At one time or another, most people have read a road sign, been distracted shortly afterwards, and then realized that they could not remember the instructions. The distraction essentially wiped the information out of working memory. Given that

Iowa DOT

This older driver is having his vision tested.

AAA Foundation for Traffic Safety

Many older drivers like this motorist may experience reduced range of motion, making it harder to rotate the head and neck and therefore more difficult to navigate skewed intersections.



This skewed intersection in Atlanta, GA, may pose a problem for older drivers. If a skewed intersection cannot be avoided, right turn on red should be prohibited.

Iowa DOT

Declines in the working memory capacity of older people can affect memory of critical navigation information provided in signs. This change can be addressed in part through redundant street signs. Here, an older man is being tested by an Iowa driver licensing official.

working memory capacity can decline with age, these types of lapses become more likely for older drivers. Providing the information several times can help limit this problem. The repeated messages create opportunities for drivers to notice the information they need in advance of a decision point so they can prepare to change lanes or turn if need be.

Older drivers often prefer driving in familiar and predictable circumstances. Unfortunately, roadways, even familiar ones, change. For example, work zones may jolt a driver's expectations because of sudden lane closures or detours. When a driver encounters new circumstances, an increased burden is placed on working memory and attention. The driver has to devote more attention and resources to determining how to navigate the new conditions.

Changeable message signs are one way that transportation agencies alert drivers to new circumstances, and designing the messages so that drivers can easily understand them is important. The last thing any transportation professional wants to do is present a message that confuses the driver. FHWA's *Highway Design Handbook for Older Drivers and Pedestrians* provides preferred strategies for presenting information on changeable message signs. Signs should be designed for a maximum of two phases (for example, phase 1: Road Work Ahead; phase 2: Left Lane Closed). For words that are too long to display, care should be taken in selecting abbreviations. What does ACC mean, for example? Does it mean "access" or "accident"? What about DLY? Is it "delay" or "daily"? The more time that drivers of any age have to spend figuring out a message means the less time they have to focus on safely operating their vehicles.

Countermeasures for Changes Affecting Older Pedestrians

Some of the same declines in musculoskeletal and physical function that affect older drivers necessarily affect them as pedestrians too. For example, common hip and leg impairments such as arthritis can limit walking comfort and distance. Loss of limb strength, flexibility, sensitivity, or range of motion, and reduced ability to rotate the head and neck all can make walking more challenging or impossible. Because walking is one of the most recommended ways for older adults to maintain health and prevent injury, the roadway infrastructure should help increase, rather than discourage, walking.

Just as roadways can be improved for older drivers, so may the infrastructure be enhanced for older pedestrians. According to 2004 NHTSA data on pedestrian safety, adult walkers over age 70 had the highest fatality rate of any pedestrians. Intersection improvements in particular are important because older pedestrians are overrepresented in intersection fatalities.

Many older adults walk more slowly than the MUTCD recommendation of 1.2 meters (4 feet) per second used for timing "flashing don't walk" signals. Slower walking speeds should be used to set traffic signal times in areas where a number of older adults are likely to be walking. The current MUTCD recommendation is based on the walking speeds of average, healthy adults, but the MUTCD allows for slower walking speeds where necessary. A walking speed of 0.9 meters (3 feet) per second covers nearly all walkers, including the elderly and people with disabilities.

The National Committee on Uniform Traffic Control Devices has reviewed research on this matter and has recently recommended to FHWA that the MUTCD guidance be revised to use a more refined process for determining pedestrian signal timing, using slower walking speeds. Such changes may be proposed in the formal rulemaking process leading to the next edition of the MUTCD.

Leading pedestrian intervals, which allow pedestrians at a crosswalk to start crossing before the light turns green for vehicles driving in the same direction, are also a good practice. The increased lead times improve pedestrian visibility in the crosswalk because they will have entered it before vehicles are allowed to make turns. Giving all pedestrians a headstart may be advantageous for older drivers as well, making it easier for them to see the pedestrians.

Arthritis and joint replacements may limit walking comfort for older pedestrians. Reducing the MUTCD design standard for signal timing to 0.9 meters (3 feet) per second can help older pedestrians cross safely. Here, a police officer halts motorists to allow time for an older woman to cross an intersection.

AAA Foundation for Traffic Safety

Countdown pedestrian signals can be another useful measure. They may reduce older pedestrians' worry about getting trapped in the road when the traffic light turns green.

Physical changes to the roadway environment can be helpful as well. Median refuges do what their name implies—they provide a safe midpoint for slower pedestrians who may not be able to complete a crossing in one cycle. In short, the transportation community has a number of tools at its disposal to help older pedestrians, and pedestrians in general, cross roads more safely and comfortably.

Many pedestrian-related infrastructure improvements will benefit everyone, including walkers of all abilities and wheelchair users. And many measures that enhance accessibility, per the Americans with Disabilities Act (ADA) and United States Access Board recommendations, often benefit older pedestrians as well. In fact, adding curb ramps, reduced cross slope, and clearing the sidewalk of obstructions are ADA design guidelines that probably improve conditions for all pedestrians.

"One of the first things municipalities need to do is to make sure that sidewalks are installed where they do not yet exist, and that all sidewalks are wide enough, unbroken, level, and not too close to high-speed roadway traffic," says John LaPlante, P.E., P.T.O.E., vice president and chief transportation planning engineer for T.Y. Lin International. "But there is a bit of a catch-22 that some measures which make it easier for the elderly to drive may increase traffic overall, making walking even less feasible for them in many areas," he adds. "One retrofit that might strike a balance between both needs is squaring corners off, or decreasing turning radii, which encourages all drivers to slow to make turns, and decreases crossing distances for pedestrians."

Looking to the Future

In the coming decades, older adults will comprise an increasing proportion of the U.S. population. This is a positive development for society because it indicates that people are living longer and healthier lives. But aging, and the chronic illnesses that become more prevalent with age, may bring about some changes in vision, cognition, and motor skills. These ability changes occur at different rates for different people, so it is incorrect to assume that all drivers of a certain age have deficits or are unsafe.

The transportation network must accommodate larger numbers of older drivers, pedestrians, and public transit users. Maximizing their ability to use the network is important since transportation plays such a significant role in maintaining independence. To the extent that older adults can safely drive or walk on their own, they will be able to preserve their quality of life.

"Thankfully, most of the infrastructure changes that communities make for older road users benefit users of all ages and society as a whole," says FHWA's Alicandri. "There are very few, if any, infrastructure recommendations that benefit older adults but hinder other road users. If you're not already an older road user, one day in the future you will be—and these infrastructure changes will help ensure that you will be able to get around safely on your own."

Lisa Phillips coordinates the American Medical Association's (AMA) Older Drivers Project. She holds a degree in urban planning from the University of Illinois at Chicago and is a bicycling and walking advocate.

Gabriel Rousseau, Ph.D., is a transportation specialist in the FHWA Office of Safety Programs in Washington, DC. He has a Ph.D. in cognitive psychology from The University of Georgia. He works on human factors and pedestrian/bicyclist safety issues.

Joanne Schwartzberg, M.D., is the director of Aging and Community Health at AMA, and she also directs AMA's Older Drivers Project.

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This article is the second in a series on older drivers and road users that is running in PUBLIC ROADS.

The Evolution of Advanced Research

FHWA outlines its plan to pursue the next generation of high-risk, high-payoff technologies and innovations to solve critical highway challenges.

by Ariam Asmerom and TaMara McCrae

Fully automated highway systems, superconcretes and smart aggregates with embedded sensors able to nondestructively diagnose problems, and self-healing pavements—are these the future of transportation? No one knows for sure, but as Benjamin Franklin once said, "An investment in knowledge pays the best interest." And history has shown that investments in advanced research have led to significant breakthroughs including space travel, nuclear energy, and the Internet.

The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) authorized a substantial increase in Federal spending on "exploratory advanced research," in the amount of $14 million per year. With this support, the Federal Highway Administration (FHWA) has embarked on a path to greater investment in high-risk, high-payoff research, aiming for breakthroughs with the potential to change surface transportation as the world knows it.

(Above) One FHWA-sponsored advanced research project involved installing fiber-optic sensors along steel rebar, shown here on a New Mexico bridge. The sensor systems can be used on "smart" bridges to detect damage and count traffic. *Photo: Rola Idriss, New Mexico State University.*

Stages of Research

Generally, research is identified as one of the following: basic, advanced, or applied.

The degree of risk and the probability for high payoff distinguishes one research stage from another. As the research focus becomes narrower toward solving a problem, so does the risk associated with the outcome. That is, the outcome becomes more predictable.

The study of phenomena and observable facts, with no specific application or desired end in mind, commonly falls into the realm of basic research, making it high risk with the potential for high payoff. Results from basic research feed into the general body of knowledge and often serve as the foundation for applied technology and innovations. For example, cutting-edge basic research on nanoscience and nanoengineering has been underway for several years. Nanoscience was born from the discovery that matter exhibits unique properties at the atomic, molecular, and supramolecular scales. Nanotechnology research is being performed with the anticipation that a deeper understanding of these properties could revolutionize the Nation's economy across many sectors.

If knowledge gained from basic research in nanotechnology is

applied to developing potential solutions for highway applications, the research then moves into the advanced stage, where the focus is narrower yet the high risk and potentially high payoff remain. Advanced research covers the broad range of progressive discoveries that could potentially move ideas from fundamental breakthrough concepts to real-world applications. Another characteristic of advanced research is that oversight typically emphasizes the judgments of technical experts rather than adherence to a programmed research plan. Similar to basic research, advanced research tends to be multidisciplinary and flourishes in a collaborative environment. Measuring the success of advanced research involves indicators such as a handoff to developers, peer recognition, citations, patents, and the generation of new concepts for further research.

If findings from advanced research on nanotechnology were to be used to develop a stronger pavement material for roads, the research then would move from the advanced to the applied stage. Applied research, as the name indicates, is even narrower in scope and risk than basic and advanced research because it pulls from previous knowledge or attempts to address a specific problem or improve the current state of the practice. Applied research is shorter term and incremental, making the outcome more predictable and problem-focused.

The Road to SAFETEA-LU

In 2002, the Transportation Research Board's (TRB) Research and Technology Coordinating Committee (RTCC) published a report titled *The Federal Role in Highway Research and Technology* (TRB Special Report 261). The RTCC, recognizing the importance of the Federal role in advanced research, made the following recommendation: "FHWA's R&T [research and technology] program should focus on fundamental, long-term research aimed at achieving breakthroughs in the understanding of transportation-related phenomena."

In the spring of 2003, FHWA published its *Corporate Master Plan for Research and Deployment of Technology & Innovation* (CMP). The CMP helped create a cohesive, organizational strategy for improving the effectiveness and efficiency of the R&T program. In particular, the second guiding principle in the CMP addresses FHWA's commitment to increasing its focus on "long-term, high-cost, and high-risk research with a high-payoff potential." FHWA's corporate advanced research agenda is expected to support research focused on breakthrough innovations beyond the near-term, incremental improvements that support and sustain the current transportation system.

On March 4, 2003, during hearings on reauthorization of the transportation research, development, and education programs, FHWA Acting Administrator J. Richard Capka discussed the importance of advanced research with the U.S. House of Representatives' Committee on Transportation and Infrastructure, Subcommittee on Highways, Transit, and Pipelines.

"Funding and conducting research and development activities of national significance is a basic responsibility of the Federal Government," Acting Administrator Capka said, "both in its leadership role to develop and advance new technologies to serve the public, and in [its] stewardship role to use national resources efficiently. At FHWA, we have emphasized this in defining our role as 'innovators for a better future.'"

He added, "To successfully accomplish our mission, we must conduct fundamental, long-term highway research; research aimed at improving safety; research aimed at significant highway research gaps and emerging issues with national implications; and research related to policy, planning, and [the] environment."

With the passage of SAFETEA-LU in August 2005, FHWA will be able to explore promising research ideas that may offer solutions to tomorrow's transportation challenges.

Below are a few highlights from recent or ongoing research at FHWA and a discussion of some of the benefits from past efforts in advanced research.

Partnership to Explore Breakthroughs in Concrete

Richard Livingston, an internationally recognized physical scientist at FHWA's Turner-Fairbank Highway Research Center (TFHRC) in McLean, VA, actively pursues opportunities to harvest basic research knowledge from other fields and adapt those known scientific approaches to possible highway applications. In 1998, after attending an international conference on conservation science, Livingston was convinced that a proven analytical method known as nuclear resonance reaction analysis could be used to explore the effect of chemicals on the reaction between water and portland cement, leading to revolutionary breakthroughs in concrete manipulation. Researchers hypothesize that adjusting concrete's setting time may facilitate its transport to construction sites, enhance the material's long-term strength, and possibly reduce the potential for cracking.

Livingston's insight led to a research partnership between FHWA, the University of Connecticut, and the Ruhr-Universität Bochum (Ruhr-University Bochum) in Germany. By measuring the cement hydration profile at the nanoscale (a minuscule scale where a nanometer is one-billionth of a meter), FHWA-funded research led to the development of more accurate models to predict the hydration process. A leading

Research Risk and Payoff

The figure relates return/payoff and risk/uncertainty with regard to research ventures. As shown, advanced research offers a higher return and payoff than applied research, yet it also involves higher risk. Of the three, basic research involves the highest risk and carries the highest potential return, whereas applied research is generally characterized as low risk with lower potential for breakthroughs with high payoff. *Source: FHWA.*

Research at FHWA

A majority of FHWA's programs are aimed at applied research defined by incremental improvements that will lower construction and maintenance costs, improve system performance, add highway capacity, reduce highway fatalities and injuries, reduce adverse environmental impacts, and achieve other user benefits.

However, FHWA also has engaged in its share of advanced research, which focuses on longer term, higher risk opportunities with the potential to dramatically change the way the United States builds, maintains, and safely operates the Nation's transportation system. The Turner-Fairbank Highway Research Center in McLean, VA, continues to lead an ongoing advanced and applied/problem-solving research program, grounded in stakeholder needs. Many of the technologies developed from advanced research are used in the field today.

For example, researchers under contract with FHWA discovered that nondestructive testing of steel structures based on the principle of magnetostrictive sensing can be used to measure tension in individual cables. Follow-on, applied research led to the commercial development of a technology that is changing conventional methods for inspecting suspension cables and monitoring tensile stresses in new ropes.

Similarly, nondestructive testing and detection of bridge damage is possible today using fiber-optic sensor systems, also a result of advanced research studies. And advanced studies of core behavioral algorithms to describe the interactions of multimodal travelers, vehicles, and highway systems have resulted in the creation of next generation simulation (NGSIM) core algorithms and datasets. Researchers are using the validated, open-source algorithms developed under the NGSIM program to create more realistic simulations of traffic patterns. View these results in more depth in the article "A Decade of Achievement" in the November/December 2002 issue of PUBLIC ROADS.

U.S. manufacturer of chemical admixtures for cement, seeing value in further development of this research, agreed to collaborate on the project. Officials from the National Science Foundation view this collaboration between industry, Government, and academia as a significant milestone in the research life cycle and recently approved a substantial grant to continue work on the project.

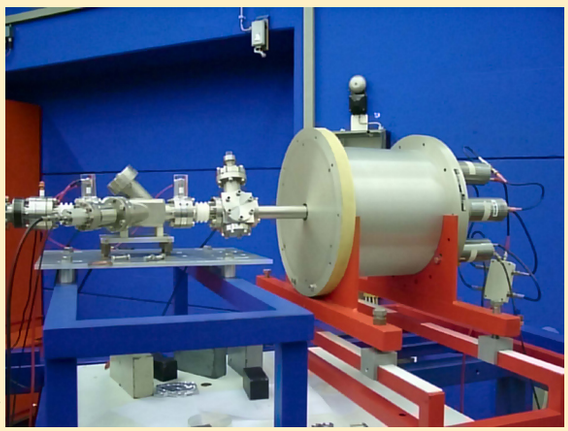
Research Spawns Multiple Safety Applications

In the mid-1990s, FHWA's Mort Oskard learned about a data analysis tool developed by the National Aeronautics and Space Administration (NASA) to explore nonlinear and nonstationary time-dependent datasets. The Hilbert-Huang Transform (HHT) opened the door to a new level of insight, leading to more detailed analyses of data features. Until NASA made this discovery, many time series analyses were founded on, and thus limited by, linear assumptions. Oskard, along with Milton (Pete) Mills and the Advanced Research Team, further developed this breakthrough in time series analysis to find potential highway-related uses.

One effort centered on developing the Digital Highway Measurement (DHM) project's instrumented van, which researchers can use to collect data on pavement and the roadway environment in terms of time series datasets. These highway infrastructure datasets are comparable to computed axial tomography (CAT) scans or the magnetic resonance imaging (MRI) technique used for medical analyses of patients. The analysis of synchronized and continuous sensor data can provide details about a highway's condition. Application of the HHT for data synchronization, fusion, and acquisition and the comparison of road profile data have been instrumental in the success of the DHM project's instrumented van. Presently, the van is capable of obtaining high-accuracy highway data while traveling at speeds up to 97 kilometers (60 miles) per hour without causing traffic congestion, thus improving safety.

Based on tremendous positive response at the Transportation Research Board's 85th Annual Meeting in January 2006, the hand-off from advanced research to applied product development and deployment may not be too far into the future. Researchers at FHWA predict that the DHM van will soon become a commercially viable instrument with numerous safety and mobility applications. The accurate data collected with the system can provide information and knowledge to improve highway safety, asset management, engineering design, and numerous other applications.

"Because ideas have to be original only with regard to their adaptation to the problem at hand, I am always extremely interested in how others have used them." —*Thomas Edison*



Professor Hans-Werner Becker, Ruhr-Universität Bochum

Shown here is a gamma-ray detector, which researchers can use to measure hydrogen in cement samples. Located in the Tandem Dynamitron facility at the Ruhr-Universität Bochum in Germany, this equipment is central to an advanced research effort involving FHWA and university researchers from the United States and Germany.

The levels of accuracy for most of the measurements the van collects are available only through this system. Potentially, the information also can be useful for safety subsystems planned by the automobile industry in future vehicle designs.

The van presently collects the following information: accurate vehicle positioning, inertial profiles, warp and curl measurements, faulting,

Developed by the Advanced Research Team in FHWA's Office of Safety Research and Development, the DHM van (shown here) can measure the condition of pavement and roadway features while driving at normal highway speeds, without disturbing traffic during data collection.

texture, joint and crack recognition, aggregate segregation, transverse roadway profiles, pavement markings, lane-wander removal, overhead clearances, clear zone information, shoulder profile, feature recognition, feature size and position, optical character recognition, and pavement thickness. Soon the van will have the capability to collect information on utilities, underground structures, voids, reinforcement steel, moisture gradient, sound (noise), and roadside measurement. More items will be added to future versions of the van.

One recent application that builds upon the data collected by the DHM van is a vehicle simulator being developed by FHWA's Human Centered Systems Laboratories. The simulator uses roadway and roadside data to test how human subjects interact with the driving environment. After collecting data on a rural road using the DHM van, FHWA researchers monitored test drivers as they navigated the same rural road. Later the measured data were input into the simulator. FHWA plans to use this technology to test driver navigation of rendered road environments recreated from the data collected by the instruments in the van. This may be the first time that accurate field data on the "as-built" roadway have been incorporated into a simulation.

Researchers already have used the simulator in other projects to study nighttime visibility on rural roads, and more recently, to simulate a new concept in interchange design that the Missouri Department of Transportation is evaluating. Researchers at TFHRC are continuing advanced research studies on the effect of complex geometries on a driver's experience and behavior in the simulator, with the goal of accurately predicting human behavior in real driving environments. Once the researchers develop a methodology to create such a simulation, they will be able to experiment with preliminary designs in the laboratory before construction in the real world.

Exemplar Projects in Advanced Research

1. Networked Atmospheric Correction Measurement
2. Real-Time Traffic Adaptive Systems
3. Multidimensional Data Visualization
4. Crash Energy Depiction
5. Two-Port Electrical Analysis Techniques
6. Hilbert-Huang Transform
7. Traffic Flow/Trip-Time Prediction
8. Meshless Methods
9. Fly Ash Reactivity
10. Delayed Ettringite Formation
11. Cement Hydration Kinetics
12. Materials and Mechanics Workshop
13. Nonlinear Dynamics Models
14. Nuclear Nondestructive Evaluation Methods
15. National Bridge Inventory Data Mining
16. Truck-Pavement Interaction
17. Asphalt and Modified Asphalt Properties
18. Characterization of Accelerated Loading Facility (ALF) Mixtures Using the Viscoelastoplastic Continuum Damage Model
19. Transportation Analysis and Simulation System (TRANSIMS)
20. Traffic Noise Model
21. Air Toxics
22. Global Climate Change

Building a More Robust Advanced Research Program

FHWA historically has conducted advanced research at some level. However, to move forward with a larger investment in advanced research, the agency needed to inventory its research portfolio to establish a baseline. Discretionary line-item funding for advanced research hovered just below $1 million per year for much of the last decade. To help establish a baseline, FHWA enlisted an independent panel of experts in 2004 to review projects identified by FHWA as *ongoing advanced research*, including policy, planning, and environmental studies. The panel's objective was to establish a more accurate picture of FHWA's investment in advanced research.

The panelists discovered that a greater portion of FHWA research activities involved advanced research than the discretionary funding level might have indicated. For example, in fiscal year 2003, FHWA dedicated approximately $7 million to advanced research that was conducted across all program areas. Among the projects identified as advanced research, the panel members also highlighted 22 projects that exemplified their understanding of the agency's role in addressing high-risk research. (See "Exemplar Projects in Advanced Research" at left.)

To set a direction for advanced research, FHWA would need to

Researchers at TFHRC use the highway driving simulator (shown here) to study nighttime visibility on rural roads and other driving circumstances.

develop a cohesive, strategic, national agenda (or plan) by involving stakeholders and partners from disciplines inside and outside the transportation sector.

Setting a Corporate Agenda For Advanced Research

In its *Corporate Master Plan for Research and Deployment of Technology & Innovation* (FHWA-RD-03-077), FHWA made specific commitments to work with stakeholders to increase the agency's advanced research efforts and to develop an advanced research plan with consolidated goals addressing national needs.

In 2005, officials from FHWA and the Volpe National Transportation Systems Center organized and convened a series of advanced research "think tank" forums to envision the future of transportation, scan for advanced technological and scientific breakthroughs, and explore possible applications of these breakthroughs to highway transportation. Held in Boston, MA; Minneapolis, MN; and Berkeley, CA, the forums brought together Federal, private sector, and academic researchers, decisionmakers, stakeholders, and partners from disciplines inside and outside the transportation sector to discuss promising basic research and technology areas that could exponentially change the future of transportation.

At the think tank forums, FHWA Associate Administrator for Research, Development, and Technology Dennis Judycki addressed participants, emphasizing FHWA's interest and commitment to enabling innovation. "It is vital that we support and manage our R&T [research and technology] programs so that they continue to produce the innovative materials, tools, and techniques that will continue to improve our highway transportation systems," Judycki said.

Futurist and forum facilitator Glen Hiemstra set the context for long-range thinking with a presentation on future trends for 2050. "If you take time to examine the longer range future, and if you think of the task not so much as predicting the future as 'listening' to it, you can discover some insightful lessons," Hiemstra told attendees.

Continuing the long-range thinking, the expert speakers identified advanced research possibilities that address one or more of the specified areas relevant to the FHWA mission, current research, and important future research needs and opportunities. The areas were focused on human performance and safety, physical performance and infrastructure, technical performance and mobility, energy and environmental sustainability, and institutional performance.

A review of the composite results illustrated major themes and clusters of research recommendations.

Major Themes and Clusters of Research Recommendations

- Human-vehicle infrastructure communications and automation. Such research may involve technology development, human factors, telecommunications, and virtual presence.
- New materials for enhanced sustainability, longevity, and reduced cost captured succinctly in the phrase "moving from nanostructure to infrastructure."
- Breakthroughs in understanding human, community, and social systems in relation to transportation innovation.
- Innovations in freight movement.
- Understanding the impacts of aging and other demographic and social trends on transportation demand, infrastructure, and vehicle needs.
- Innovation in pricing and financing transportation in the next energy era.

Source: FHWA.

An Eye Toward the Future

"The coming decade seems to strongly suggest that business *not* as usual will be the norm, and all kinds of new thinking is required," says Debra Elston, director of the FHWA Office of Corporate Research and Technology. "Increasing demands, limited resources, and greater expectations will be the driving forces that determine the future of transportation. We need radically new mechanisms to set a preferred direction for the future."

Based on feedback from the think tanks, FHWA officials determined that the following would be necessary to solidify an advanced research agenda:

- Advanced research needs to be truly long term, assuming at least linear change over the next 25 years, especially regarding information technology. Linear change means that 2025 will be at least as different from 2005 as 2005 was from 1985, and that at least that level of technology advancement and social change will occur by then.
- Advanced research needs to take into account the increasing likeli-

hood of major energy transformations over the next 25 years, with implications for vehicles, infrastructure, financing, safety, and social and economic systems.
- Advanced research ought to reflect the need for a significant revolution in community design to accommodate an aging population, which is currently underemphasized.
- Advanced research should take seriously the materials revolution, especially nanotechnology and lightweight materials, linking basic research elsewhere in these fields to transportation and highway needs.
- Advanced research needs to leverage research consortia and establish effective partnerships. Further, it will need to use an appropriate mix of traditional and innovative, results-based research incentives.

Two key elements necessary for the successful execution of an advanced research agenda already are in place. First, FHWA has responded to its own as well as external assessments identifying the need for a stakeholder-driven agenda-setting process. Toward this end, the 2004 external assessment helped establish an agency portfolio of ongoing advanced research. In 2005, the think tank forums provided stakeholder input and research recommendations for future consideration. FHWA conducted each of these activities to capture the contributions and opinions of stakeholders and customers.

The second key element is the commitment made by Congress and authorized under SAFETEA-LU to support an exploratory advanced research program at FHWA.

FHWA Associate Administrator for Infrastructure King W. Gee was pleased with the level of involvement and interest demonstrated by stakeholders during the think tank forums. "There seems to be tremendous support from our university and State partners to focus on nonincremental research that addresses some of the fundamental issues facing surface transportation," he says. "The recent authorization [SAFETEA-LU] offers FHWA the opportunity to greatly energize our efforts on advanced research in search of innovative solutions that improve safety and reduce congestion. Who knows what we might discover?"

Summary: Lessons From the Future

1. The future creates the present.
2. Breakthroughs must be compelling.
3. People you see in 2050 will be different.
4. Energy tipping point is approaching.
5. Great technology revolutions to come.
6. The way it is is not the way it will be, economically or environmentally.
7. Travel—vehicles, roads, systems—will evolve or change fundamentally.
8. Systems should be integrated.
9. Every impossible thing may someday be possible.

Source: 2050 Future Trends presentation by Futurist Glen Hiemstra.

Ariam Asmerom, FHWA

Ariam Asmerom, FHWA

Participants are at work during think tank meetings in Minneapolis, MN, (top) and Berkeley, CA (bottom).

Ariam Asmerom, P.E., is a transportation specialist and coordinator of FHWA's advanced research initiative in the Office of Corporate Research and Technology. She has 15 years of experience in transportation planning and engineering, working in both the public and private sectors before joining FHWA in 2001. Asmerom has a bachelor of science degree in civil engineering from the University of Virginia.

TaMara McCrae is a marketing specialist in the FHWA Office of Corporate Research and Technology. She has worked for 10 years in the transportation field, including a position in public affairs at FHWA and work with the Center for Alternative Dispute Resolution in the Office of the Secretary of Transportation. McCrae holds a bachelor's degree in psychology from St. Mary's College of Maryland and a master's degree in counseling psychology from Bowie State University.

The participants in the advanced research think tank forums provided tangible ideas that are helping FHWA propose and implement a well-rounded strategic agenda for advanced research. For more information, contact Debra Elston at 202-493-3190 or Ariam Asmerom at 202-493-3469 in the Office of Corporate Research and Technology.

Following the Flow

by Norm King, Sam Talje, Michael F. Bloom, Jeff Scarborough

TxDOT's new approach to monitoring highway runoff promises improved compliance with clean water standards.

State departments of transportation (DOTs) operate drainage systems that include ditches, channels, storm sewers, and culverts to manage stormwater and runoff. In addition to stormwater, these systems can carry pollutants, such as sediment, bacteria, trash, metals, and oils, from road surfaces to natural waterways. Agencies that operate urban stormwater drainage systems need to develop and implement detailed plans for reducing pollutant levels in the runoff they discharge. They also need to obtain permits that detail the requirements included in their plans, mandate annual reporting to the governing regulatory agency, and require documentation of compliance activities.

Many transportation agencies rely on hardcopy forms to document compliance with regulations regarding stormwater management. But this approach has limitations. One challenge in particular is producing reliable records demonstrating that stormwater discharge points, known as "outfalls," were inspected frequently enough. (An "outfall" is the point at the end of a stormwater conveyance, such as a pipe or channel, at which the stormwater enters receiving waters, such as a creek.) In addition, physical access to hardcopy forms may be restricted when forms are stored in one site and needed in another. Making phone calls and exchanging hardcopy documents among DOT staff to support both decisionmaking and demonstrations of compliance can be time consuming. Data may be available only in text format, making it difficult to display key information graphically, unless a map is specially produced for the task. These limitations become apparent when the data are required for a compliance audit, when demonstrating compliance may become a cumbersome task.

The Texas Department of Transportation (TxDOT) recently met these challenges by developing an electronic, automated tool that collects, stores, and retrieves information on compliance with stormwater regulations. According to TxDOT officials, the Outfall Tracking System (OTS) will streamline annual reporting, facilitate field survey and inspection work, reduce compliance costs, provide greater access to information on drainage systems, improve distribution and delegation of permit compliance duties, and create a framework for automating and tracking compliance in the future.

"[Although] it took a huge commitment of time and resources upfront to create this powerful tool, TxDOT will reap the benefits for decades," says Dianna Noble, director of the TxDOT Environmental Affairs Division.

For stormwater management and monitoring, moving from hardcopy to electronic records is the trail blazed in Texas.

DOTs as Stormwater System Operators

The burden of proof of compliance, which rests with State DOTs and other entities that release pollutants or are otherwise responsible for managing them, can be traced to the Federal Water Pollution Control Act Amendments of 1972, better known as the Clean Water Act. The act aimed to regulate "point" sources of pollution (for example, sewage treatment plants) entering the Nation's "navigable waters." Subsequent years saw a general expansion of Federal and State regulatory involvement, and in 1987 the U.S. Congress authorized the U.S. Environmental Protection Agency (EPA) to develop and expand the National Pollutant Discharge Elimination System (NPDES) to regulate urban discharges of stormwater pollutants (Section 402).

In the early 1990s, EPA issued Phase I regulations, as they are commonly known, which covered urban centers with populations greater than 100,000. Phase II regulations, issued in 1998 but effective in 2003, added smaller locations

(Above) The Houston, TX, area receives more than 114 centimeters (45 inches) of rain per year, much of it during major storms like the one shown here, flooding a local roadway not operated by TxDOT. TxDOT recently developed a GIS-based system to support the management of stormwater runoff from Texas highways. *Photo: PBS&J.*

within "urbanized areas," as defined by the U.S. Census Bureau. Both sets of regulations require that certain entities, including State DOTs, develop and implement stormwater management programs.

Focusing on Illicit Discharges

In Texas, as in any State, the stormwater management program must be designed to reduce pollutants to the maximum extent practicable as required in the Clean Water Act and its implementing regulations. The program must include (1) public involvement, education, and outreach; (2) construction runoff and postconstruction stormwater management for new development and redevelopment; and (3) good housekeeping, that is, minimizing or eliminating contact between stormwater and onsite pollutants, such as oil used for auto repair.

In addition, any stormwater program must include a component focused on detecting and eliminating illicit discharges, which are nonstormwater discharges that generally contain higher pollutant loads. Examples include drainage from unlicensed commercial carwash operations, leaking sanitary sewers, or improperly plumbed industrial sites.

The illicit discharge program requires periodic field inspections of outfalls during dry weather. Field data must include the outfall location, any physical observations, flow rate, and water quality measurements, if flow is present. Once illicit discharges are identified, additional investigations must track down their sources and, if possible, eliminate them either directly or through third-party actions, such as notifying a State regulatory agency or neighboring municipality. The agency or municipality can then levy appropriate fines or enforcement actions. Illicit discharges can contribute high levels of pollutants that degrade receiving waters. Therefore, regulatory agencies tend to emphasize strict implementation of this portion of a discharger's stormwater management program.

Moving Toward Electronic Tracking

In 2004, TxDOT started updating its approach to managing data, beginning with illicit discharge

This inspector is recording information about a small outfall using a tablet computer to record structural and environmental information about the outfall pipe. The white dome in his backpack is the GPS receiver, which uses satellite signals to obtain a fix on the exact location.

PBS&J

compliance, as it was the most data intensive of the agency's stormwater programs. Managers of the stormwater program and information technology staff in four TxDOT divisions and districts worked together to develop a model for how outfall data would be collected, stored, and retrieved. TxDOT's Houston and Dallas Districts, along with the Information Systems and Environmental Affairs Divisions, also participated in developing the comprehensive data management tool, which came to be known as OTS (Outfall Tracking System).

OTS is a collection of programs, Web pages, and a relational database with geographic information, also called a "geodatabase." The initial system, largely completed by the summer of 2005, included the following components:

- A customized field data collector used to gather information during outfall inspections
- Web pages for collecting and loading data associated with laboratory analysis results, desktop mapping of outfalls, and other sources
- A statewide relational geodatabase that stores outfall information along with reference information on geographic and other physical features, such as streams, rivers, streets, roads, and geopolitical boundaries
- A Web-based map viewer that displays, saves, and prints full-color maps with color-coded outfalls (based on classification) along with geographic information
- Custom, Web-based reporting tools that display and print photographs, documents, sketches, and tabular information on outfalls

As of December 2005, data collection functions were still under development. Although the current OTS only accommodates manual loading of data, TxDOT officials anticipate that the system will be able to upload data electronically by the summer of 2006. Web-based functions for data collection will enable users to upload desktop mapping information, hydrology information, and the results of laboratory analyses. Users also will be able to synchronize outfall inspection results from tablet personal computers (handheld devices that can be carried and used in the field to facilitate collecting data electronically). Users also will be able to create status updates, input descriptive information about an outfall, and create links to scanned documents.

"OTS is so comprehensive because it came about through a collaborative, cooperative effort," says Jim Crisp, an environmental specialist with TxDOT's Dallas District. "This is a tool [that] all TxDOT districts can use to address regulatory compliance needs in a technologically advanced manner. OTS not only provides huge labor savings for us, it is extremely user friendly too."

Outfall Organization

Because the Houston metropolitan area is flat, has relatively impermeable soils, and is subject to intense rain exceeding 114 centimeters (45 inches) per year, local transportation officials sought a high level of detail on stormwater outfalls and the contributing drainage areas.

To capture this information, TxDOT developed an approach to collecting and mapping data on desktop computers that involves the following steps:

- Collecting "as-built" drawings illustrating the final configuration of constructed drainage infrastructure

System Design

The OTS design architecture developed by TxDOT includes components based on geographic information systems (GIS) and Environmental Systems Research Institute, Inc. (ESRI) software including the following:

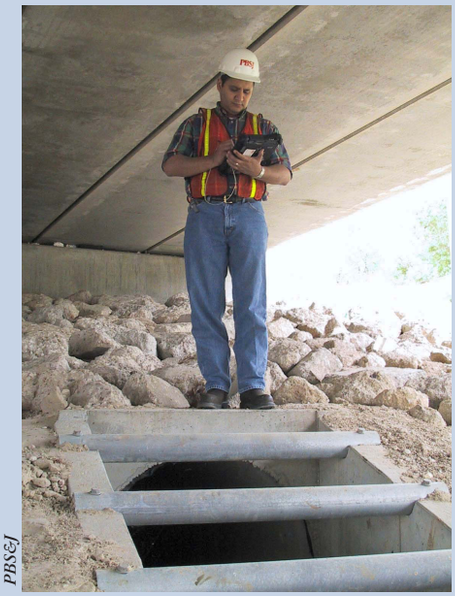
- SQL/Oracle® geodatabase
- ArcSDE® spatial database engine
- Web portal for easy information access and retrieval
- ArcIMS® Internet map server
- Automated desktop digitization applications for ArcGIS® and MicroStation
- ArcPad® application for automated field data collection, integrated with a global positioning system (GPS)
- Tadpole Technology's Go! Sync™ automated geodatabase synchronization from field data collectors
- Automated reporting for compliance regulations

The relational database contains 42 spatial feature classes, 26 nonspatial tables, and 97 tables for choosing domain attributes. The following systems and data are included in the design:

- Political and organizational boundaries
- Aerial photography
- Roadways
- Topography
- Land use
- Floodplains
- Watershed boundaries
- Outfalls and contributing drainage areas
- Crossing points and contributing drainage areas
- Outfall inspection results
- Hydrography (streams and rivers)
- Instruments and calibration records
- Laboratory results

The map viewer application was developed using ESRI's ArcIMS with ArcMap Server software, ASP, and JavaScript™. The Web interface application was developed using ASP.NET and the C# programming language.

The application that collects field data is a customized application of ESRI ArcPad software using Microsoft Visual Basic® scripting. Synchronization is performed using Go! Sync software combined with a Web application for transferring nonspatial data.



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An inspector records information about an outfall located under a highway overpass. In situations such as this where the overpass blocks transmission of GPS satellite signals, inspectors can define the outfall location by clicking on a detailed aerial photograph of the site displayed in ArcPad on the tablet computer screen.

- Digitizing the drawings and positioning them in the proper coordinate system
- Tracing relevant portions of the drawings so key information on drainage systems can be imported into OTS
- Documenting tabular supporting information about each object, such as a description of the material, shape, size, and location
- Loading the information into OTS

Customized desktop mapping tools and procedures support two mapping processes: inside the right-of-way (ROW) mapping and outside ROW mapping. The former captures information about roadway drainage areas discharging stormwater runoff through outfalls. Outside ROW mapping captures information about regional watersheds draining to hydraulic structures, such as culverts, pipes, and channels, at roadway crossings.

"This information is enormously useful in tracing the source of an illicit discharge, one of our most challenging tasks," says Crisp. "ROW mapping also can be called upon in drainage studies and planning efforts."

Peak runoff flow rates at stormwater discharge locations can assist agencies with determining pollutant loads as well as aid in planning and designing drainage systems. TxDOT also is developing a way to collect data on hydrologic values that will use traditional calculations to determine the peak runoff flow rates arising from hypothetical storms. These calculations generally follow TxDOT's design manual procedures. Calculated values will be stored in a simple spreadsheet and then uploaded to OTS and the main geodatabase.

Field Inspection Improved

According to Crisp, one of the most powerful OTS tools is the field data collector, which is a transportable tablet computer that enables inspectors to record inspection results electronically rather than on hardcopy forms. During an outfall inspection, as part of the assessment of whether an illicit discharge may be present or is suspected, field staff members make and record a number of measurements and observations about the outfall. Inspectors typically determine if any flow is present. If so, they record the flow characteristics, such as odor and color, and measure and record water quality parameters using field instruments. Other indicators of an illicit discharge are assessed, such as the presence of foam, staining, distressed vegetation, or deposits.

In addition, field observations confirm the size, material, shape, and other physical factors of the outfall. Field researchers use the tablet PC to record and then document the coordinates of the outfall using digital photos and sketches. After completing the field work, some geographic information may need to be converted to a consistent coordinate system, and the collected data will be uploaded to OTS and then to the main geodatabase.

With the mobile OTS field data collector, TxDOT staff members can enter all this information electronically via simple drop-down menus and point-and-click computer functions. Field staff also may view

TxDOT staff who collect data in the field can use the rugged Tablet PC (personal computer), shown here, even in bright direct sunlight. The computer's internal mounting hardware and rubberized corners make it impact resistant. *Photo: Xplore Technologies® Corp.*

detailed maps and aerial photographs of the area being surveyed.

"Field survey efficiency is improved dramatically with the easy-to-use functions and the ability to see previously surveyed outfalls, landmarks, roads, streams, and other features in the field," Crisp says.

Intelligent Data Storage

All collected information, whether from field survey work, desktop mapping, or other input methods, is stored in a geodatabase that relates all collected information to objects and features in space. This means that information about a particular outfall is linked to geographic information, including the roadway, receiving stream, county, TxDOT district, land use, and drainage area. Each outfall, in turn, is linked to all of the inspection, hydrology, and desktop mapping results from that outfall.

According to Sonny Lelle, systems analyst/technical project leader for TxDOT's Information Systems Division, the heart of OTS is its approach to storing relational data. "With these linkages, powerful reporting and data visualization tools can be created," Lelle says.

In addition to an intelligent approach to storing relational data, OTS includes custom programming to process data and to populate some geodatabase fields automatically, without user intervention. One of these programs helps Texas stormwater managers decide which outfalls require followup investigations by placing each outfall into one of the following categories of illicit discharges: unlikely, potential, suspect, or obvious.

Artificial intelligence features of the OTS software classify outfalls by considering a combination of visual and physical observations of vegetation conditions, staining, or odors; field-measured water chemistry results; and laboratory-measured water chemistry results. The software program used to make the classification assignments runs overnight and identifies all new outfall inspection results loaded into the geodatabase from the previous day.

"Now stormwater managers can review inspection results within a day to determine which outfalls require followup actions," says Crisp. "That improves the effectiveness of our investigations or third-party notifications."

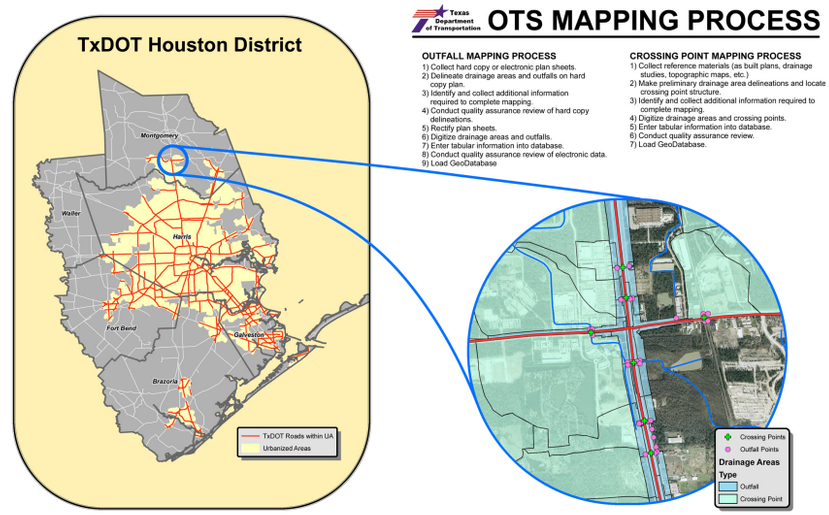
Better Mapping And Reporting

TxDOT officials report that the logical relationships, geographic information, and artificial intelligence features of OTS make the tool especially useful for reporting and mapping. Users select from an array of views and formats to create the reports needed for compliance and decisionmaking.

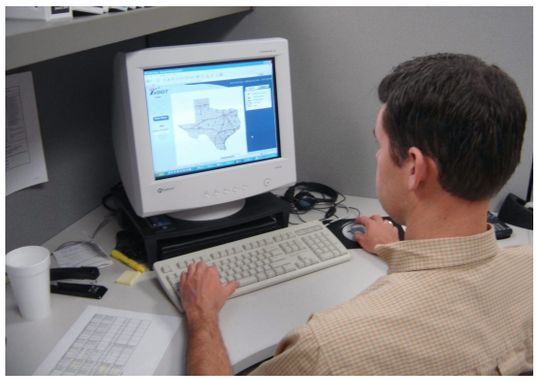
OTS can display, print, or save information in a graphic map format or in text-based reports. The map viewer offers an interactive screen that enables users to zoom, pan, and display a variety of geographic information. The map viewer includes access to political and organizational boundaries, aerial photography, roadways, topography, water bodies, floodplains, and land uses, as well as outfalls, crossing points, and contributing drainage areas.

Users also may generate maps in Adobe® Portable Document Format (PDF) files, which can be printed, saved, or e-mailed to others. Outfalls that were inspected in the field are automatically color coded, based on inspection findings, to indicate the likelihood that an illicit discharge is present. TxDOT stormwater managers have found the mapping feature to be a valuable tool for planning and prioritizing inspection activities as well as followup investigations to eliminate illicit discharges.

Five standard, text-based report formats are available using the OTS data manager. TxDOT designed the reports, which feature tables of data, to provide stormwater



In this screen capture from the desktop mapping tool, the left side shows a map of the major TxDOT roads within the urbanized areas in the Houston District. The right side lists the procedures for mapping outfalls and crossing points. A closeup portion represents an aerial photograph of a highway intersection with the mapping results, including the location of crossing points and outfall points, superimposed upon the photo. *Source: PBS&J.*



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TxDOT employees now have full access via desktop computer to a wide spectrum of information on NPDES-permitted outfalls throughout the State.

managers with information to support decisions, input into annual reports, and document compliance activities. The reports also can be used to manage and track inspection work performed by contractors and third parties. Standard reports include the following:

- *Outfall Datasheets*, which summarize an outfall's physical characteristics, location, mapping and inspection histories, latest inspection results, and hydrologic information to assist with maintenance and followup inspections. These reports, and the Crossing Point Datasheets, are text-based and include two small embedded photographs.
- *Crossing Point Datasheets*, which provide a summary of a crossing point's physical characteristics, location, mapping history, and hydrologic information to assist with planning and maintenance activities.
- *Outfall Inspection Activity Reports*, which detail inspection activities on individual outfalls and indicate the location, date of inspection, inspection type, inspecting organization, discharge status, and status and date to manage contractors and keep track of inspection rates.

These and the other reports listed below are text-based and appear in tabular format.

- *Inspection Results Reports*, which summarize physical observations recorded at an outfall, such as odor, color, size, and material to support followup investigations to eliminate illicit discharges.
- *Outfall Water Chemistry Reports*, which list the chemical constituents (field- or laboratory-measured) present in any flow detected from an outfall to support followup investigations to eliminate illicit discharges.
- *Statewide Outfall Summary Reports*, which summarize inspection activities statewide and indicate the location, date of inspection, inspection type, inspecting organization, discharge status, and status and date to manage contractors and keep track of inspection rates.

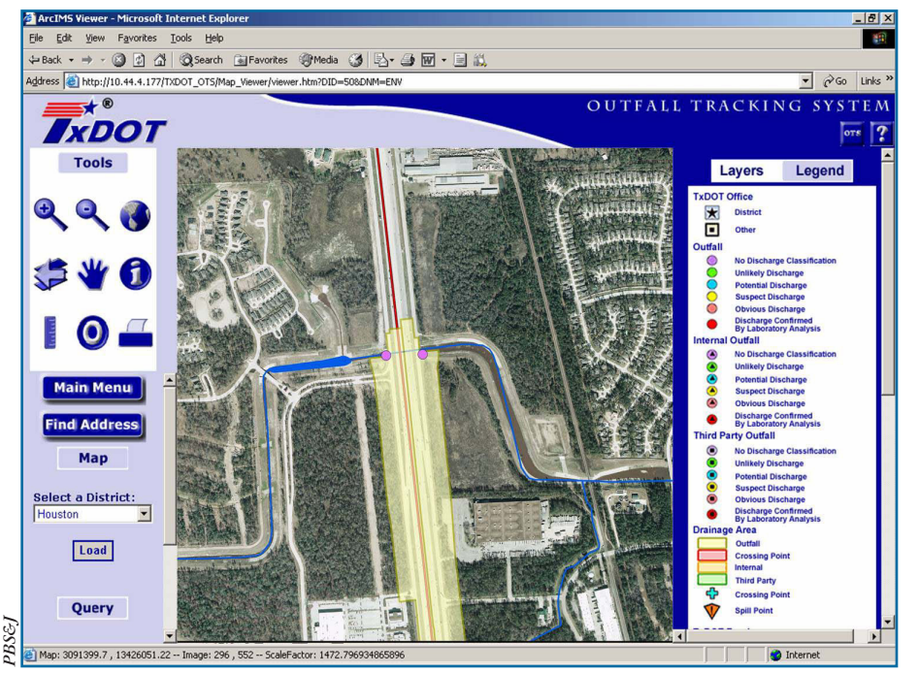
Standard reports have fixed column headings; however, they are designed to enable the user to select the data displayed under them. Users can restrict or sort the data by defining criteria such as date range, geographic area, outfall type, roadway, waterway, investigation status, discharge classification, or size category.

Easy and Secure Access

All TxDOT employees who perform regulatory compliance duties will have access to OTS through the Internet using standard Web browsers such as Microsoft® Internet Explorer.® Various levels of secure access are granted to ensure data integrity and restrict editing, viewing, and copying rights. Distributed access across the organization means more rapid retrieval of needed information. It also means that TxDOT can delegate compliance duties to a broader array of staff using the tool.

"With OTS being a Web-based system, we were particularly concerned about security," Lelle says. "For instance, we voiced concerns that the source code could be vulnerable to SQL [structured query language] injection. Effective communication between the Information Systems Division and the contracting staff resolved that concern."

SQL, both a programming language and a specific database used by TxDOT, can be vulnerable to hackers. When protections



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This screen shot from the OTS map viewer zeroes in on an aerial photo of a stream crossing beneath I–45 north of Houston. Purple dots represent uninspected stormwater outfalls, and yellow shading represents outfall drainage areas. The OTS map viewer interface includes navigation, printing, and search tools (shown on the left). On the right, layer selection buttons enable users to change the information displayed, and a legend tab identifies the symbols and colors used on the map.

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Once construction is complete, new outfalls like the one shown here for an overpass on the Westpark Tollway outside of Houston can readily be incorporated into TxDOT's OTS.

are not in place, a user or hacker might enter programming commands to delete or modify otherwise secure information.

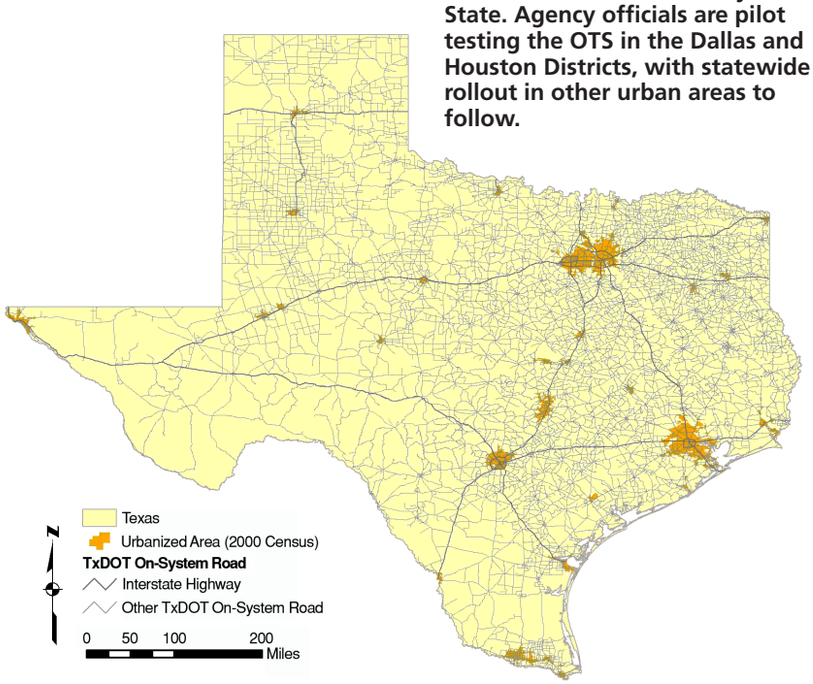
The current version of OTS allows data editing only with proper login credentials. An updated version, now under development, will add comprehensive data change tracking and reporting. This improvement will facilitate the automatic collection, storage, and retrieval of edited information, including the date of the change, the person making the change, the old record, the new record, and the reason for the change. These features will further enhance stormwater compliance and ensure a high level of data integrity.

Looking Ahead

As of December 2005, the first version of OTS is complete and available to TxDOT staff via a secure Web server. The electronic field data collector is undergoing pilot testing in the Dallas and Houston Districts, and desktop mapping is underway in Houston. Automatic upload functions for hydrologic data, mapping information, and field inspection results will be finalized during the spring and summer of 2006.

Planning is underway for an expanded set of tools for tracking compliance to better manage information associated with other programs that address stormwater quality, namely public education, public involvement, construction, runoff controls, new development, good housekeeping, and representative monitoring.

TxDOT officials look forward to implementing these additional data management technologies to further streamline compliance with stormwater quality regulations and reduce costs. These features will enhance the State's automated collection, storage, and retrieval tool that already facilitates accurate inspection surveys and reporting, improves data accuracy and access, and simplifies compliance reporting.



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TxDOT maintains more than 79,000 centerline miles of roadway in the State. Agency officials are pilot testing the OTS in the Dallas and Houston Districts, with statewide rollout in other urban areas to follow.

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SAFETEA-LU provisions aim to bolster professional, management, and technical skills and expertise at State DOTs.

Acting Now, Building for the Future

by Vicki Glenn

Over the years, generations of hard-working men and women provided the intellectual, technical, and physical expertise and ingenuity to construct, manage, and operate the U.S. transportation systems that move goods and people around the country.

Now, as many in the industry are reaching retirement age, an emerging challenge is to find, hire, and retain a workforce with the necessary skills and qualifications that ensure the continued successful operation of the system in the future. To meet the challenge, the U.S. Congress incorporated a number of provisions related to workforce development into the recently enacted Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). The legislation provides resources that enable the U.S. Department of Transportation (USDOT) and its public and private sector partners to bolster existing activities and develop new ones to help nurture and prepare a new generation of transportation professionals to succeed in the workforce.

An Industry and Workforce In Transition

A look at the expected demographics of the future workforce paints a troubling picture. According to the U.S. Department of Labor, growth in the U.S. workforce declined from a high of 2.6 percent in the 1980s to a low of 1.2 percent in the 1990s, with a projected growth rate of only 0.2 percent from 2015 to 2025.

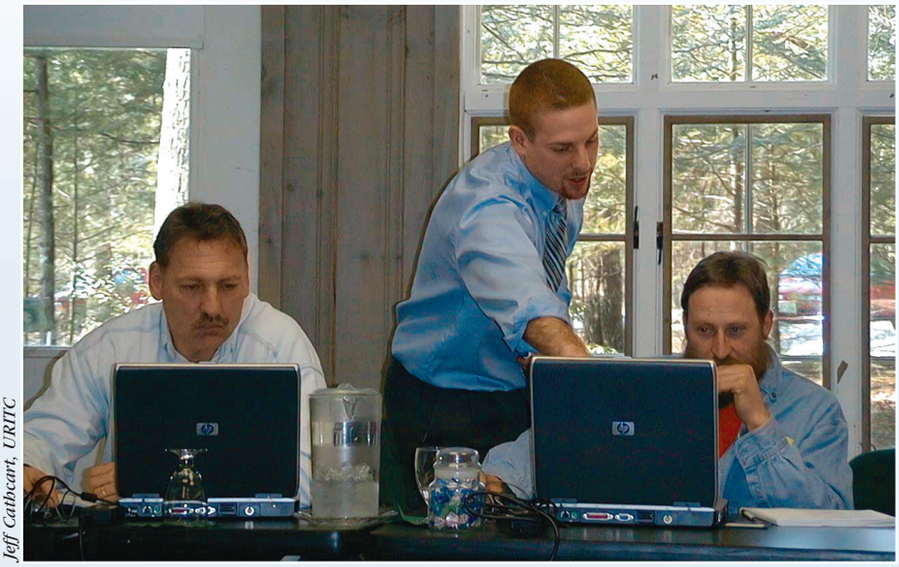
Compounding the situation is the fact that many in the baby-boom generation will begin to retire in 2006.

The transportation workforce requires an increasingly diverse set of job skills, including welding for steel bridge fabrication. Here, a bridge maintenance welder from the Rhode Island Department of Transportation is introducing students to arc welding during Rhode Island Construction Career Days in May 2005. *Photo: John Peterson, URITC.*

The numbers are more immediate for the transportation field, where up to 50 percent of the technical workforce will be eligible to retire in 2010. More than one-third of senior managers at State departments of transportation (DOTs) are eligible to retire immediately, with another 10 percent eligible in just 3 years. Concern about workforce development and retention affects all facets of the transportation industry, as the public and private sectors compete for the same smaller pool of eligible workers.

Over the last decade, full-time employment at State DOTs decreased while transportation agency budgets have increased dramatically. Another emerging challenge is that DOT employees now supervise contractors who perform work previously conducted by State employees, requiring State employees to have additional skills in contract and project management, oversight, and business. Rapid changes in transportation technology mandate ongoing training for employees, and program delivery demands drive the need for workers with new, diverse skills.

"Our research shows that to do business in this era, transportation workers need a broader range of skills," says John Horsley, executive director of the American Association of State Highway and Transportation Officials (AASHTO). "Earlier in our industry, strong engineering skills were the focus, and other skills—in such areas as finance or communications—were considered complementary but not essential. Now, they're crucial because the nature of our business has changed. Interacting and communicating with the public is a major need now, as is understanding the why and how of environmental requirements."



Jeff Cathcart, URITC

Working on laptop computers, these transportation professionals are learning to use new computer software during a workshop sponsored by the Rhode Island Technology Transfer Center.

Workforce Initiatives Provide Support and Perspective

As the interstate construction era drew to a close in the mid-1990s, industry leaders began serious study and evaluation of the future workforce challenge. The Federal Highway Administration (FHWA) collaborated with its professional and industry partners on a series of activities and research-related studies that laid the foundation for many of the workforce development initiatives included in SAFETEA-LU. Some of these earlier efforts include the following:

CEO Strategic Management Forums. In June 2002 and May 2003, FHWA, AASHTO, and the Transportation Research Board (TRB) invited chief executive officers (CEOs) from State DOTs to participate in workshops on key strategic management areas—one of which was workforce development. An important outcome, documented in *TRB Circular 501*, was consensus for stronger investment in employee recruitment and retention, as well as better sharing of best practices between the States.

National Workforce Summit. A summit held in May 2002 brought together public and private sector leaders from the transportation and academic communities to focus on the challenge of attracting and retaining a qualified technical and professional workforce now and for the future. Participants identified the need for the transportation community to become more involved in attracting young people to transportation careers and to better coordinate training efforts across the industry. To demonstrate their commitment, summit participants agreed to work together through a Partnership for Educating, Training, and Developing the Nation's Transportation Workforce.

TRB Special Report 275, The Workforce Challenge: Recruiting, Training, and Retaining Qualified Workers for Transportation and Transit Agencies. This 2003 study cited the need for more DOT investment in training, adding that more Federal funds should be available for training and education. Further, the report found that transportation agencies need to partner with universities, community colleges, training institutes, and Local Technical Assistance Program (LTAP) centers to meet workforce development needs. Another priority cited in the report was to establish cooperative partnerships between transportation agencies, the private sector, educational institutions, unions, and employees to focus on innovative practices for managing human resources.

AASHTO Strategic Plan 2005–2010. In a 2004 AASHTO survey, CEOs from State DOTs identified training and workforce issues among their highest priorities and inservice training for professional and technical personnel as one of their most pressing needs. The subsequent *AASHTO Strategic Plan 2005–2010* includes such goals as expanding training opportunities and collaborating with other transportation associations, the Federal Government, and other entities to inform State DOT managers and supervisors about the array of course offerings.

These construction workers are assessing material excavated from a pit dug several feet below the surface of the road. Tomorrow's engineers and designers may discover innovative materials and techniques to create more durable, longer lasting, and safer roadways. In addition, new monitoring and evaluation technologies will reduce the need for road maintenance and related traffic disruptions.

In a report requested by AASHTO and prepared under the National Cooperative Highway Research Program, Tom Warne, president of Tom Warne and Associates, LLC, conducted the interviews about inservice training needs, speaking with CEOs and training and human resources personnel from State DOTs.

"The CEO perspective is especially important because some are private sector professionals appointed to their positions, while others bring State government experience and perspective to the job," says Warne. "Perhaps more important is their commitment to change within their agencies, demonstrated by the integration of workforce development into the State DOT strategic planning process."

Warne defines inservice training as "training provided to employees both to maintain their current skills and to provide new skill development to meet changing job requirements or agency needs." The skills cited in the report as increasingly important for DOT staff demonstrate a dramatic departure from those traditionally associated with an agency's mission of construction, maintenance, and operations:

- *Project and program management* require financial and administrative abilities to deliver larger projects and multiple smaller projects.
- *Public and stakeholder relations* entail skills in public outreach, meeting facilitation, and consensus building.
- *Leadership* skills need to be developed and applied throughout the agency to prepare individuals for senior management positions.

SAFETEA-LU Favors Industry-Wide Institutional Change

In 2003 many of the provisions included in the House and Senate versions of the transportation reauthorization bill pointed toward the need for a more comprehensive approach to fostering an industry-wide workforce. Indeed, some workforce concerns raised by leaders in the transportation industry had been resonating with legislators since 1998 when they debated the previous law, the Transportation Equity Act for the 21st Century (TEA-21).

Signed into law in August 2005, SAFETEA-LU authorizes Federal surface transportation programs for highways, highway safety, and transit for fiscal years (FY) 2005–2009. SAFETEA-LU provides more than $26 million annually for training and education programs, with $4.75 million for new programs for fiscal years 2006–2009. SAFETEA-LU also allows State DOTs to fund training and education through five core programs: the Surface Transportation Program

To continue developing innovative designs for transportation infrastructure, such as this bridge in Vermont, the public and private sectors need to recruit and retain well-educated engineering and design professionals.

(STP), Bridge Program, Interstate Maintenance Program (IM), National Highway System Program (NHS), and Congestion Mitigation and Air Quality Improvement Program (CMAQ). States are not required to provide matching funds; workforce development activities can be funded with 100-percent Federal funds.

SAFETEA-LU Section 5204(e) provision funding is discretionary, meaning that States can commit a portion of federally allocated core program funds to workforce development. The amount committed, however, will reduce the State's funds available for capital projects. But some States regard investing in workforce development as necessary to the success of effective capital programs and their overall transportation missions.

Section 5204(e)(3) of SAFETEA-LU defines workforce development as "activities associated with surface transportation career awareness, student transportation career preparation, and training and professional development for surface transportation workers, including activities for women and minorities."

SAFETEA-LU efforts also focus on recruiting qualified workers at various technical and professional levels throughout their careers and fostering a work environment that provides professional development and training opportunities throughout each employee's career.

Funding Distinctions

Section 5204(e) of SAFETEA-LU permits State DOTs to use funds from five core programs—Surface Transportation Program (STP), National Highway System Program, Interstate Maintenance Program, Congestion Mitigation and Air Quality Improvement Program, and the Bridge Program—for workforce development activities, such as employee education and training and other career outreach and preparation initiatives. These activities can be 100-percent federally funded. Below are answers to frequently asked questions about using SAFETEA-LU funding for workforce development.

How do the workforce provisions affect funding available in the core programs?

The use of core program funds for workforce development is discretionary; therefore, funds committed to that end will reduce funds available for capital projects. However, because the investment in workforce development will ensure that workers have the skills and knowledge necessary to work efficiently, funding this activity is an essential complement to capital programs and the States' overall transportation missions.

How do workforce development provisions differ between TEA-21 and SAFETEA-LU?

TEA-21 authorized States to use up to 0.5 percent of STP funds for employee training but required States to provide a 20-percent matching provision. SAFETEA-LU provides 100-percent Federal funding for workforce development activities, extends eligibility for the activities to the five core programs, and does not limit the amount of Federal funding a State can use from each program. SAFETEA-LU also authorizes "pipeline" programs to help students prepare for transportation careers.

What are examples of pipeline programs that core funds can support?

According to SAFETEA-LU language, States may use funds for "education[al] activities, including outreach, to develop interest and promote participation in surface transportation careers." This includes activities associated with preparing students for transportation careers, such as transportation-related internships, cooperative educational programs, activities to support universities and colleges, and scholarship programs (other than the Dwight David Eisenhower Transportation Fellowship Program, which is funded separately).

How else can State DOTs use core program funds?

States may use the funds for a range of professional development activities, such as training programs, academic course studies, apprenticeships, short-term work details, or rotational assignments. Funds also may be used for training or professional development necessary to support a specific surface transportation capital project, such as a major roadway or bridge construction project.

Cooperative workforce development activities, aimed at using limited resources more effectively, need to focus on alternative ways of developing skills and delivering training. As a complement to traditional classroom training, shown here, other methods such as Web- and computer-based instruction, distance learning, and Web-based professional networks can make training accessible and affordable to a broader audience.

Can core program funds be used for travel or equipment and material purchases?

Yes. However, travel and purchases must be directly related to a defined employee training or professional development need, program, or activity, or directly associated with a student transportation career awareness or preparation activity. State DOTs also can use funds to cover the cost for travel to and from an industry training or professional development program, such as an NHI course, that will improve an employee's skills, knowledge, and abilities. Examples of pipeline activities that core program funds can support include bus transportation for students to participate in career awareness or development programs such as Construction Career Days. The funds also can pay for materials for transportation-related programs such as AASHTO's TRAC and AGC's Build Up! programs.

Can core program funds be used as matching funds for other Federal programs such as LTAP or UTCs?

No. Federal funds cannot be used to match other Federal funds, unless specifically provided by the statute. There are no statutory provisions that allow core funds to be used to match other federally funded programs.

John Peterson, URITC

A training instructor is demonstrating how the controls work in this mini excavator. More than 1,000 students from across the State learned about careers in the construction and transportation industry while participating in Rhode Island Construction Career Days in 2005.

Under the direction of an instructor, this student is lifting an I-beam into place using a crane simulator. This mobile training unit enables participants to simulate operating heavy equipment in a safe environment at a fraction of the cost of using an actual crane.

John Peterson, URITC

The SAFETEA-LU language builds on ideas developed at the 2002 workforce summit, looking at workforce development as (1) a continuum designed to help students perceive transportation as an important and rewarding career, (2) activities to prepare students for careers in transportation through college and postgraduate programs, and (3) an ongoing effort for current employees to continue to develop their knowledge and skills as transportation professionals. Various SAFETEA-LU provisions focus on the continuum concept by funding programs to increase awareness of transportation career opportunities in elementary and middle schools, refine skills development in secondary schools and colleges, and support technical training to meet continuing professional development needs throughout an employee's transportation career.

The law also expands the focus of the following programs to enhance transportation workforce development:

Garrett A. Morgan Technology and Transportation Futures Program, SAFETEA-LU Section 5204(d). USDOT established this program in 1997 to generate awareness of transportation careers in elementary and secondary schools, but current provisions fund it for the first time at $1.25 million annually for FY 2006–2009. The curriculum will complement existing efforts in the private sector, including the AASHTO Transportation and Civil Engineering (TRAC) Program and the Associated General Contractors' (AGC) Build Up! program.

University Transportation Centers Program (UTC), Section 5401. SAFETEA-LU expands the UTC program from participation at 33 universities to 60 institutions and provides a stronger connection to national research needs and transportation education. Provisions also require each UTC to establish an education program that includes multidisciplinary coursework and 5 to 10 degree programs closely related to highways and public transportation.

SAFETEA-LU also establishes new initiatives:

Transportation Education Development Pilot Program, Section 5204(f). SAFETEA-LU provides funds to establish a pilot program to develop training and educational curricula for all workers involved in delivering highway programs. Funding can support development of university and community college curricula for individuals coming into transportation and for current transportation employees with management, technical, and vocational job responsibilities.

Transportation Scholarship Opportunities Program, Section 5505. This new scholarship program authorizes Federal DOT operating administrations and nongovernmental institutions to establish scholarships and mentoring programs with nongovernmental institutions. The program is entirely discretionary, and no funding is provided; however, the

SAFETEA-LU at Work in West Virginia

As in other States, retirements and attrition led officials with the West Virginia Department of Transportation (WVDOT) to become concerned about loss of managers and technical professionals. Restrictions in TEA-21 on matching funds left the agency unable to invest in a wider range of training options. WVDOT had supported technical training, but limited resources left the agency short of funding for workforce and leadership development for the future.

With the passage of SAFETEA-LU, however, States now have many more options—and opportunities. "When training funds are limited, important management training is often neglected," says West Virginia Division of Highways Commissioner Paul Mattox. "Given our particular needs, elimination of the matching requirement under SAFETEA-LU could not have come at a better time for WVDOT. This provision has allowed us to schedule much-needed training opportunities for our staff."

Gary Lanham, training director for the WVDOT Division of Highways, is spearheading the initiative. "It's critical that we plan and implement a long-term strategy to create agency leaders and ensure our technical excellence," Lanham says. "SAFETEA-LU gives us the flexibility to draw on numerous resources and partnerships."

For example, in January 2006, agency leaders completed a course based on Stephen R. Covey's course and publication, *The 7 Habits of Highly Successful People*. To demonstrate its commitment, the agency enrolled several "Train-the-Trainer" personnel as participants, and these trainers will present course highlights to nearly 700 WVDOT employees across the State. The agency is exploring additional training opportunities, including teaming with Marshall University's Nick J. Rahall, II Appalachian Transportation Institute to identify needs and opportunities.

The FHWA Division Office in West Virginia is involved as well, working with WVDOT to develop a long-term, programmatic, and strategic approach to workforce development. According to FHWA West Virginia Division Administrator Thomas J. Smith, "The comprehensive approach by WVDOT, along with an emphasis on partnerships, promises an opportunity for synergy that will benefit the greater transportation community. SAFETEA-LU gives DOTs additional options for collaboration, creating a brighter future for the transportation industry."

framework enables the transportation industry to develop a more comprehensive scholarship program.

SAFETEA-LU also continues support for FHWA's core training and professional development programs, including the National Highway Institute (NHI), LTAP, and the Dwight David Eisenhower Transportation Fellowship Program.

FHWA Commitment to Workforce Development

SAFETEA-LU provides an opportunity to develop the transportation workforce by enhancing current programs and creating model programs that can be replicated throughout the industry. Now it is up to transportation managers and decisionmakers to put these tools to use, build upon the progress achieved over the past few years, and continue to demonstrate the effectiveness of collaborative initiatives in addressing workforce issues.

"There has been progress because of the continuing commitment of a number of transportation organizations," says FHWA Associate Administrator for Professional and Corporate Development Joseph S. Toole. "The SAFETEA-LU workforce provisions provide additional opportunities, but it will be the collective efforts of the transportation community that will provide our greatest opportunities for success."

Vicki Glenn is a transportation project manager with CACI Premier Technology, Inc., and has supported FHWA projects since 1992. Previously, she worked with the FHWA Office of Professional and Corporate Development to research and write about innovative State DOT practices to recruit, train, and retain qualified employees. She is a member of TRB's Committee on Transportation Education and Training, where she cochaired the Committee's 2003 forum on transportation internships and related mentorships. She holds a B.A. in humanities from Macalester College and an M.A. in education from American University.

For more information, contact Clark Martin at clark.martin@fhwa.dot.gov.

These young people are participating in a project to replant vegetation along a widened highway in Maryland. Activities such as this show children that career paths in the transportation industry can vary widely from engineering and construction to biology and landscape design.

The Battle of Its Life

by Richard F. Weingroff

Even as construction continued at a record pace, the Interstate System needed a rescuer—and found one in Rex Whitton of Missouri.

On November 8, 1960, Senator John F. Kennedy (D–MA) defeated Vice President Richard M. Nixon in the presidential election. President Dwight D. Eisenhower and his successor were from different generations and political parties, but Kennedy—the first President born in the 20th century—shared Eisenhower's concern about the future of the National System of Interstate and Defense Highways.

In December 1962, Federal Highway Administrator Rex Whitton challenged State highway officials to finish half the Interstate System by the midway point in the program, which was then expected to end in 1972. This exhibit was created to illustrate the challenge.

In 2006 the transportation community celebrates the 50th anniversary of the Eisenhower Interstate System. The third in a three-part series, this article examines how Federal and State highway officials addressed the day-to-day challenges, as well as the broader difficulties, of executing the country's largest public works project.

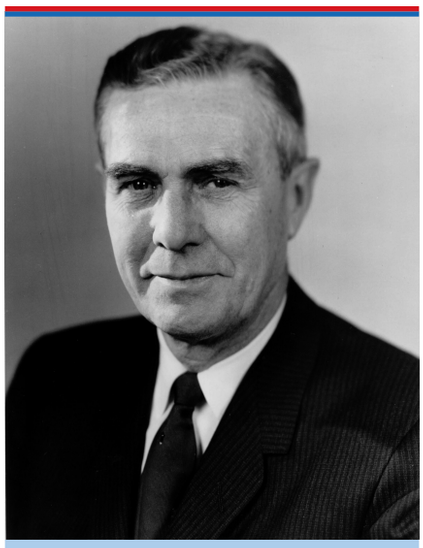
Challenges for the New Administration

Several problems confronted policymakers. Even as construction moved at a record pace, a looming fiscal crisis threatened to derail the schedule, if not the program. According to the 1961 Interstate Cost Estimate (ICE), Congress would have to provide an additional $11 billion to maintain the schedule. Controversy dogged construction in urban areas. The press repeated tales of alleged corruption and bungling that had given the program the disparaging label "our great big highway bungle."

President Kennedy would have to address these issues before calls to end the Interstate program grew too loud to ignore. He selected Governor Luther H. Hodges of North Carolina to be Secretary of Commerce. Within that agency, the new Federal Highway Administrator of the Bureau of Public Roads (BPR) would be Rex Whitton.

Whitton's career with the Missouri State highway agency had begun in 1920 when he accepted a job operating a level on a survey crew for $110 a month, plus field expenses. He became chief engineer in 1951, leading to his role as president of the American Association of State Highway Officials (AASHO), as it was called then, in 1956. Whitton represented AASHO before Congress during this critical year and oversaw revision of the 1945 geometric design standards for the Interstate System. The new edition was approved in July 1956 and quickly adopted by BPR. Whitton also had ensured in August that Missouri would have the first project to go to contract after President Eisenhower approved the Federal-Aid Highway Act of 1956.

Whitton's first speech as Federal Highway Administrator was to a meeting of the American Road Builders Association in Atlantic City, NJ, in March 1961. The Interstate System, he said, "can and must be completed by 1972" as scheduled. He saw three challenges. The first was the funding problem, and the second was the "scandals" that were undermining public support. The third was "public apathy, or at least a lack of full appreciation of the urgent need for the highway program and the benefits it is bringing." Increased public education was essential in the face of the negative publicity, he said. "There is no instant panacea for the trouble besetting the highway program," but he promised to "give the job everything I have."



Amid calls for an end to the problem-plagued Interstate program, Rex M. Whitton (shown here) became the third Federal Highway Administrator on February 10, 1961.

The Funding Problem

The funding problem would be addressed promptly. In February 1961, President Kennedy wrote to Congress, "Our Federal pay-as-you-go highway program is in peril." He justified the special message by citing the "vital contribution" of the program to security, safety, and economic growth, as well as national defense. He opposed "stretching out or cutting back" the program, two options that critics had suggested.

He explained that in 1959 President Eisenhower had signed legislation increasing the gas tax to 4 cents per gallon as a temporary measure that would expire July 1, returning the tax to 3 cents. The reduction, President Kennedy wrote, "was vigorously opposed by the previous administration. It is opposed by this administration with equal vigor." Overall, he recommended tax changes that would add $9.7 billion over roughly a 10-year period, or about $900 million per year, for the Interstate program.

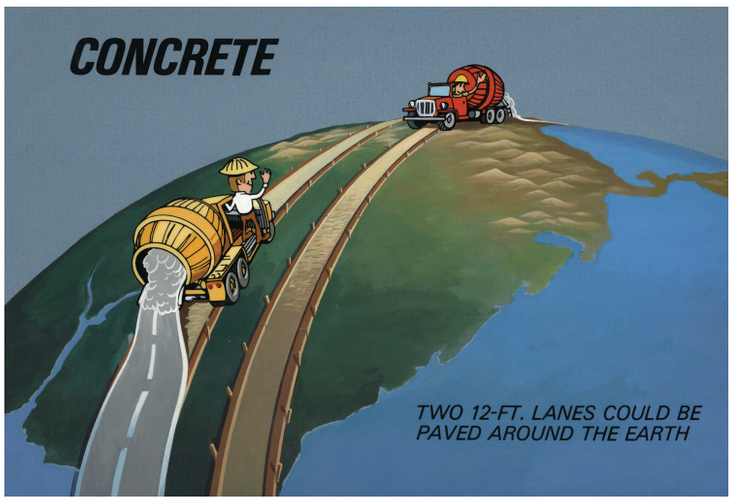
The President also addressed urban development issues. He wrote that he had directed Commerce Secretary Hodges and Housing and Home Finance Administrator Robert C. Weaver "to increase their joint planning at every level, to improve coordination of urban renewal and freeway construction plans in the same area, and to invite the cooperative efforts of State and local highway and housing officials and private experts." In addition, Kennedy encouraged legislation to help families displaced by highway construction to find "reasonable housing at reasonable costs"—a problem that "has been largely overlooked," he wrote.

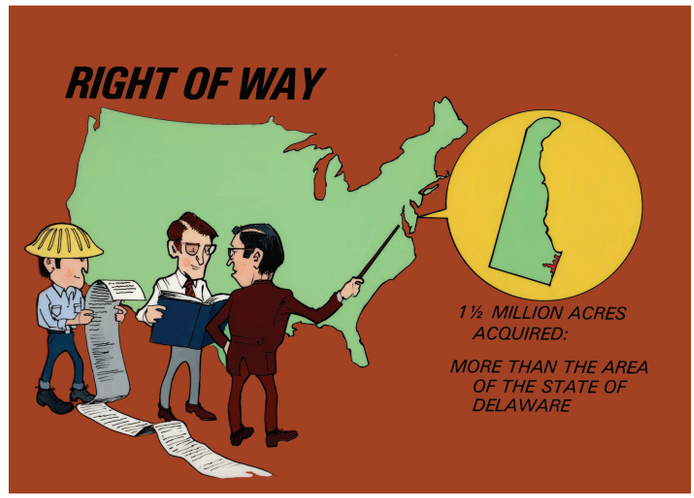
Congress acted quickly. On June 29, exactly 5 years after President Eisenhower had approved the 1956 law, President Kennedy approved the Federal-Aid Highway Act of 1961 with, he said, "the greatest pleasure." The new law made the 4-cent gas tax permanent and adjusted other excise taxes to support completion of the Interstate System on the basis of the latest ICE. It also adjusted remaining authorizations for the system to a total of $25.2 billion over 9 years. With State matching funds, the legislation accounted for $27 billion in funding for the remainder of the program through fiscal year (FY) 1971, the same amount Congress had thought in 1956 would be the total cost of the program.

After Kennedy's signing of the 1961 act, completion of the Interstate System was never again in doubt.

Construction accelerated throughout the early 1960s. By the end of 1962, 23,023 kilometers (14,300 miles) of the Interstate System had been opened. A year later, 26,726 kilometers (16,600 miles) were open.

President Kennedy gave Whitton one of the pens used to sign the legislation. "It is not an expensive pen," Whitton would recall, "but it is the most important one I ever owned, for it was an instrument of writing a solution to the highway





financing crisis which has bothered so many of us for several years."

Getting the Message Out

In April 1961, President Kennedy issued a proclamation declaring that the week of May 21–27 would be National Highway Week. It was an opportunity for Federal and State highway officials, and the Nation's Governors, to remind the public of the "vital role of highway transportation in our way of life."

Whitton began a public relations initiative to counter the bad press the Interstate program was receiving. The campaign included his appearance at highway openings around the country, each an opportunity to gain positive publicity in local newspapers. By the time he left office in December 1966, Whitton had attended more Interstate openings than any Federal Highway Administrator before or since.

As he traveled the country, Whitton continued to meet with the press to share his optimism about the future awaiting the country in the early 1970s when the Interstate System would be completed. Typical was an article he wrote that appeared in Sunday newspapers around the country for the Commerce Sunday Feature Service in August 1964, which ended, "Today, wherever we look throughout our country, we find that the Interstate System is spurring new industrial and commercial development, creating new jobs, and generating new economic growth for the benefit of all Americans."

The Great Highway Robbery

These efforts coincided with continued negative press coverage. For example, the investigative journalist Jack Anderson wrote about "The Great Highway Robbery" in the February 4, 1962, issue of *Parade* magazine. He quoted Representative John A. Blatnik (D–MN), who headed the Special Subcommittee on the Federal-Aid Highway Program, as saying, "Corruption permeates the highway program and stigmatizes the whole road-building industry." The committee's counsel, Walter May, suggested throwing a dart at a U.S. map. "Wherever it sticks, we can find something wrong with the new highways."

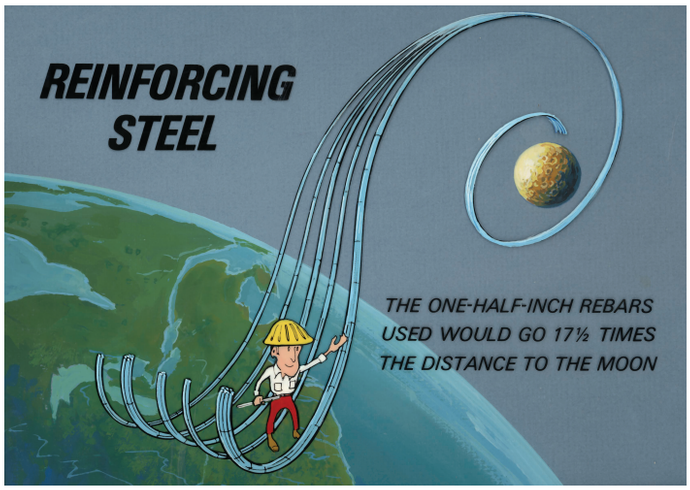
The coverage usually cited examples of graft, payola, abuse of right-of-way appraisals, and poor judgment brought to the attention of the Blatnik Committee, often involving a small number of States.

In response, BPR strengthened program controls. In July 1962, it established an Office of Right-of-Way and Location, to be headed by longtime employee Edgar H. Swick. The new office would be responsible for route location and ensuring that right-of-way would be acquired properly and at fair cost. In addition, former FBI agent Joseph M. O'Connor would direct a new Office of Audit and Investigations, which would probe allegations of fraud, land speculation, collusion, and other irregularities, as well as audit State claims for reimbursement of the Federal share of project costs.

At the same time, BPR was cooperating fully with the Blatnik Committee, the FBI, General Accounting Office, and State investigative units. Beginning in May 1961, the committee issued reports on its findings. The reports covered such topics as highway construction practices in two States, right-of-way acquisition in a third State, and the relationship between road contractors and State personnel as well as disposition of right-of-way improvements in another State.

In June 1962, Chairman Blatnik summarized his committee's findings in a speech to the Western Association of State Highway Officials. "The areas in which we have found…faults are only a small fraction of the total of this great program," he said. He warned the highway officials not to overrate "the unjustified conclusions and editorials in the newspapers." Instead, they should note congressional support for the program, especially in comparison with the attitude in 1959 when "wild speeches" were being made in the House about "extravagance, inefficiency, waste, graft, and so forth." Now, he said, lawmakers knew that any incidents they heard about from constituents would be investigated and resolved.

The Blatnik Committee, combined



To illustrate the magnitude of the "greatest public works project in history," BPR prepared these illustrations in 1961 showing how much concrete, right-of-way, and reinforcing steel would be needed.

with policing efforts by BPR, the State highway agencies, and investigative agencies, defused the crisis. The allegations would resurface in later critical articles and books, but the danger to the program was over.

The President's Message On Transportation

In March 1962, Commerce Secretary Hodges and Housing and Home Finance Administrator Weaver reported to the President on redressing urban transportation problems. The major objectives, they said, "are the achievement of sound land-use patterns, the assurance of transportation facilities for all segments of the population, the improvement in overall traffic flow, and the meeting of total urban transportation needs at minimum cost."

Their report recommended that beginning July 1, 1965, approval of Federal-aid highway projects in any metropolitan area should be contingent on a finding by the Commerce Secretary that the projects "are consistent with adequate, comprehensive development plans for the metropolitan area or are based on results of a continuing process carried on cooperatively by the States and local communities" so that the Federal-aid system "will be an integral part of a soundly based, balanced transportation system for the area involved."

With mass transit increasingly operated by public agencies rather than the for-profit companies that had dominated the field in the 1950s, the report continued, Federal funding to subsidize needed service was vitally needed. "Mass transportation must be viewed as a public service and often cannot be a profit-making enterprise," it said.

In April, President Kennedy submitted a message to Congress on "The Transportation System of our Nation." The message covered a wide range of topics, including freight shipments by land, air, and water; international aviation and maritime issues; and labor relations related to transportation workers. The message began: "An efficient and dynamic transportation system is vital to our domestic economic growth, productivity, and progress. Affecting the cost of every commodity we consume or export, it is equally vital to our ability to compete abroad. It influences both the cost and the flexibility of our defense preparedness, and both the business and recreational opportunities of our citizens."

President Kennedy recommended that Congress establish a long-term program of Federal aid to urban mass transportation ($500 million over 3 years) in the form of direct grants to public agencies for rights-of-way, fixed facilities such as maintenance sites and terminals, rolling stock (vehicles), extension and rehabilitation of existing systems, and creation of new systems.

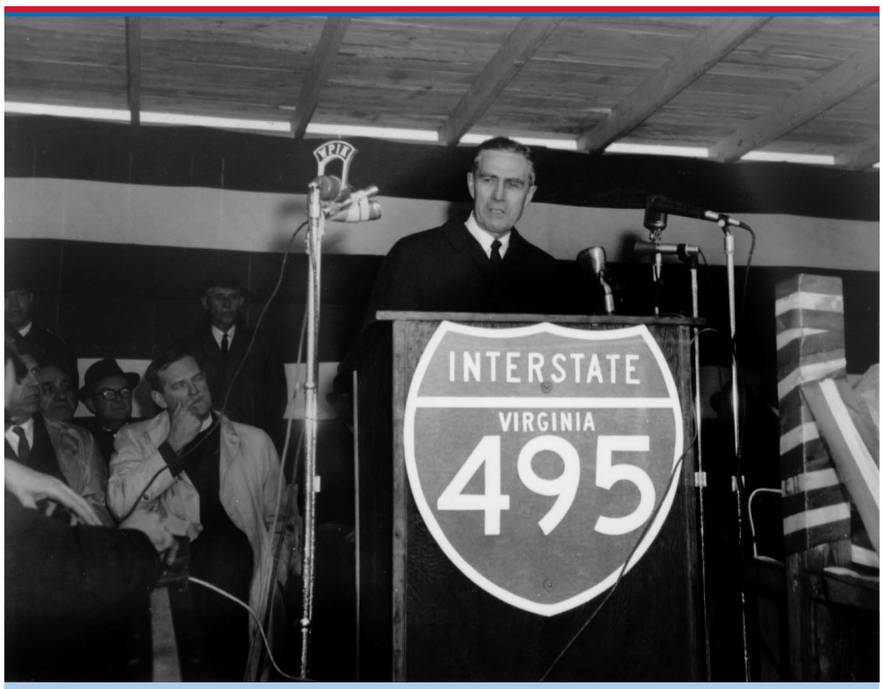
Because highways would remain an "instrumental part" of urban transportation, the President asked for changes in U.S. Department of Commerce policy and Federal law to bring urban Federal-aid highway construction more in line with the comprehensive development plans for metropolitan areas. In addition, he cited Secretary Hodges's estimate that 15,000 families and 1,500 businesses were being displaced by Interstate construction each year. With Federal urban renewal programs as a model, President Kennedy submitted legislation "to authorize payments not to exceed $200 in the case of individuals and families and $3,000…in the case of business concerns or nonprofit organizations displaced as a result of land acquisitions under these programs."

Addressing the Urban Crisis

The Federal-Aid Highway Act of 1962, which President Kennedy signed on October 23, completed action on the highway portion of his transportation message.

Section 5 addressed the growing concern, cited by the President and in a number of critical articles, about relocated individuals and businesses. Before approving a project, the Commerce Secretary would have to be assured that the State highway agency would provide advisory assistance for displaced families. He also was required to approve Federal-aid participation in relocation payments by the State to displaced residents and businesses. The dollar limits proposed by the President were adopted.

The most important provision



Rex Whitton participated in more completion ceremonies for Interstate highways than any other Federal Highway Administrator. Here he is shown marking the opening of Virginia's portion of the Capital Beltway (I–495) on April 2, 1964.

was Section 9, "Transportation Planning in Certain Urban Areas." It addressed the President's call for a means of ensuring that Federal-aid highway and mass transportation programs would be part of a comprehensive and balanced urban transportation plan. The provision added Section 134 to Title 23, United States Code, which launched modern transportation planning by calling for "a continuing comprehensive transportation planning process carried on cooperatively." What became known as the "3C" process remains the core of Section 134, which now contains nearly 20 subsections.

To address the new planning requirements, State and urban officials formed ad hoc planning committees to reflect the "cooperative" element of the 3C process and hired consultants to gather and process data. Neither Section 9 nor the BPR's instructional memorandum on implementing it required formation of a permanent planning organization; however, the metropolitan planning organizations of today, required by the Federal-Aid Highway Act of 1973, would evolve from these early efforts to comply with the 3C requirement.

A Challenge to AASHO

When AASHO gathered in December 1962 for its annual meeting, Whitton included a challenge for State highway officials in his annual speech. Given the continuing criticism of the Interstate program, Whitton pointed out that "nothing succeeds like success." Each Interstate highway, he said, "is its own best advertisement" of the benefits of freeways. Building the Interstates as fast as possible "is the best means we have to combat the carping critics and mudslingers."

With the Interstate program funded through FY 1971, the halfway point was 1964 for the 15-year program. Therefore, Whitton challenged State highway officials to complete 50 percent of the Interstate System, or 32,200 kilometers (20,000 miles), by the end of 1964. He urged the States to focus on projects that would link longer route sections, especially those connecting large cities. Such routes, he said, "best demonstrate to the public the benefits of the system—time saving, travel ease, and safety."

The Quiet Crisis

With this challenge before them, State highway agencies continued construction at a fast pace. But even as the new highways became an integral part of the American way of life, the image of the Interstate System suffered. The ideas that informed the decade—such as stewardship of the environment, guarantee of civil rights, expansion of the role of women, and the questioning of authority—meant that no amount of public relations and optimistic predictions about highways without stoplights could overcome the negative image the Interstate System had received in its first years.

A turning point came in September 1962 with the publication of a book, Rachel Carson's *Silent Spring*, which had nothing to do with the Interstate System. *Silent Spring*, which described the effect of chemicals such as DDT on the environment, was an immediate international bestseller and made the environment a major national concern. After *Silent Spring*, the public began to see the relationship between human endeavors that, however well intended, had adversely affected the environment. This "quiet crisis," as Interior Secretary Stewart Udall called it in 1963, would require a "new conservationist" in the form of ecologists, botanists, and biologists.

The quiet crisis would soon become another concern that highway engineers had not anticipated. For BPR and the States, the location of highways had not involved concerns about the environment. Rather, road builders sought the best routing to provide traffic service at the lowest cost with the least disruption to homes and businesses. Now, new criteria would have to be considered. Less than a year after *Silent Spring*'s publication, BPR announced in August 1963 that beginning January 1, 1964, the States would be required to certify, for each Federal-aid highway project, that they had considered its possible effects on fish and wildlife. Discussing this change, Whitton said, "We do not seek to despoil the countryside." He added that "our responsibility . . . is to spend the highway user's dollar wisely," but the new environmental emphasis demonstrated that "we do not have closed or calloused minds."

Although Whitton would present the new requirement as a "conservation" measure, it was one of many steps the highway engineers would take—willingly in some cases, not so

willingly in others—in the wake of *Silent Spring* to adjust to an evolving public awareness that meeting transportation needs had environmental consequences that should be considered along with congestion relief, economic development, safety, and other traditional factors.

President John F. Kennedy

In October 1963, President Kennedy approved the Federal-Aid Highway Amendments Act of 1963, a technical corrections bill that contained an important change in the design of Interstate projects. The 1956 law had called for Interstate projects to be designed to meet traffic demand in 1975. As that year came closer, Federal and State highway officials and key Members of Congress began to worry about construction of highways that would soon be obsolete. Therefore, the 1963 act required design for a 20-year period commencing on the date of plan approval. (The Federal-Aid Highway Act of 1966 made another key change in design standards by requiring that "such standards shall in all cases provide for at least four lanes of traffic.")

A few weeks later, on November 14, 1963, President Kennedy helped open the Maryland Northeastern Expressway and the Delaware Turnpike (I–95), which were separate State toll roads that met at the State line. More than 10,000 people attended the ceremony, staged at the State line, for what would prove to be the only time a President has participated in an Interstate opening. The President said of the new turnpike: "It symbolizes…first of all, the partnership between the Federal Government and the States, which is essential to the progress of all of our people; and secondly, it symbolizes the effort we have made to achieve the most modern Interstate highway system in the world, a system which, when completed, will save over 8,000 lives a year and $9 billion in cost. And third, it symbolizes the effort which we are giving and must be giving to organizing an effective communication system here in the United States of America."

As the President spoke, civil rights protestors marched on the Delaware side within a dozen feet of the platform. One protester held a sign that read: "Mr. President, you're opening highway No. 95. Now, help us open public accommodations."

After concluding his brief remarks, President Kennedy joined Governor Elbert N. Carvel of Delaware and Governor J. Millard Tawes of Maryland to clip the ribbon opening the road.

Eight days later, on November 22, President Kennedy was assassinated in Dallas, TX.

A year after that, in January 1965, during a ceremony in the lobby of a Hot Shoppes restaurant on the turnpike, Governor-elect Charles L.

Representative John A. Blatnik was appointed to head a Special Subcommittee on the Federal-Aid Highway Program in September 1959. He came to the post expecting to find widespread corruption, but came to believe any problems were largely isolated. Representative Blatnik, second from right, is shown here on September 14, 1971, cutting the ribbon to rename the I–535 Duluth-Superior Bridge the "John A. Blatnik Bridge."

The Maryland Northeastern Expressway-Delaware Turnpike opened on November 14, 1963, with President John F. Kennedy helping to cut the ribbon before a crowd of 10,000. Left to right: Governor Elbert N. Carvel of Delaware, Kennedy, and Governor J. Millard Tawes of Maryland. The turnpike was renamed the John F. Kennedy Memorial Highway in 1965. *Photo: John F. Kennedy Library.*

Terry, Jr., of Delaware, unveiled a bust of the late President by sculptor Maurine Ligon of New Castle, DE. With the unveiling, the highway in Delaware and Maryland was officially renamed the John F. Kennedy Memorial Highway.

"Separate," Not "Equal" Transportation

The new President, former Vice President Lyndon B. Johnson, would play an important role in ensuring civil rights for African-Americans and other minorities, but he had little effect on the Interstate System. Indeed, the system had been planned long before the civil rights movement gained broad public and political acceptance.

The period when the Interstate System was conceived in two reports to Congress, *Toll Roads and Free Roads* (1939) and *Interregional Highways* (1944), was very different from the world facing the Interstate builders. In accordance with the 1896 Supreme Court decision in *Plessy v. Ferguson* that had rendered "separate but equal" facilities acceptable, public accommodations along the Nation's roads throughout the South and adjacent States were racially separate. Elsewhere, de facto segregation was common.

Neither of the key reports discussed race. However, in drafting them, the then-head of BPR Thomas H. MacDonald and his top assistant, Herbert Fairbank, explained that one of the most beneficial roles of the Interstate System would be revitalizing America's cities. The urban world MacDonald and Fairbank wrote about in the 1939 report was one in which the automobile had encouraged "the outward transfer of the homes of citizens" and businesses to the suburbs. Urban homes were now "occupied by the humblest citizens" who lived along the fringe of the business district—"a blight near its very core!"

At a time when society was embracing "slum-clearance projects," *Interregional Highways* explained, the essential role of Government "would be to facilitate the transition financing of the rehabilitation of blighted areas, to employ its powers of eminent domain in the public interest, and to fix the standards of redevelopment." To accomplish the "radical revision of the city plan," sufficient right-of-way should be acquired, the report said, "for adjacent housing, airport, park, or other public developments which the highways will be designed to serve in part."

MacDonald and Fairbank proposed creation of a Federal land acquisition agency to buy rights-of-way and transfer them to the States. They did not address how

displaced families and businesses would move on with their lives.

By the time President Eisenhower signed the Federal-Aid Highway Act of 1956, the Supreme Court's 1954 ruling in *Brown v. Board of Education* (of Topeka, KS) had overturned *Plessy v. Ferguson* and declared the broader segregation of American society unconstitutional. In 1955, a tired seamstress named Rosa Parks, of Montgomery, AL, boarded a bus at the end of a routine workday. Her arrest for refusing to yield her seat to a white passenger touched off a bus boycott that received national attention and helped lift the Reverend Martin Luther King, Jr., to the pinnacle of the civil rights movement. Parks's arrest gave new life to the civil rights movement, just as Rachel Carson's *Silent Spring* would spark the environmental movement a few years later.

As Interstates began to run through blighted areas, the civil rights movement was gaining momentum. It gave the "humblest citizens" a voice, an urgency, a legitimacy that MacDonald and Fairbank could not have anticipated. These newly empowered citizens would face a tough fight as the economics of highways, and sometimes the racist times, directed the new freeways into their neighborhoods.

For example, in a study of the impact of Interstates on cities, Professor Raymond A. Mohl of the University of Alabama at Birmingham explained how officials in one city rejected using an abandoned railroad corridor in favor of routing an Interstate through an inner-city community of African-Americans, wiping out housing in another along with the cultural and commercial heart of the community. In a northern city, an elevated freeway was used to separate a black public housing project from white ethnic neighborhoods. Elsewhere, State plans to route a freeway through a historic district were blocked by preservations, but plans for an elevated Interstate through a minority community went ahead, leaving behind "a devastated black community, a concrete jungle left in the shadows by a massive elevated highway." Professor Mohl cited similar examples in many other cities.

Lady Bird Johnson (right) was instrumental in making aesthetically pleasing views from the road an important goal of the Interstate System. In May 1965 she embarked on a "Landscape-Landmark Tour" in northern Virginia, taking I–95 and parallel U.S. 1 to compare the two highways. Mrs. Johnson posed with Federal Highway Administrator Rex Whitton and his wife, Callie Maud, who brought homemade cookies to share with participants on the bus ride.

Federal Highway Administrator Rex Whitton, right, meets with Secretary of Commerce John T. Connor, who took office in January 1965, about an Interstate route in Buffalo, NY.

The urban revitalization that MacDonald and Fairbank thought would accompany the Interstates was derided as building "white men's roads through black men's homes." Moreover, the reconfiguration of transportation to favor highways over transit was harmful to transit-dependent minority communities, contributing to high rates of unemployment and civil unrest. Highway officials were in the difficult position of defending what were increasingly perceived as racist policies.

Professor Mohl concluded that the "forced relocation of blacks from central-city areas triggered a massive spatial reorganization of urban residential space. . . . The expressway building of the 1950s and 1960s, then, ultimately helped produce the much larger, more spatially isolated, and more intensely segregated second ghettos characteristic of the late twentieth century."

Some State highway and city officials were following the inexorable logic of routing the urgently needed highways where right-of-way expenses would be lowest and revitalization most needed, although others made racially motivated decisions, as Professor Mohl documents.

In part, Federal and State highway officials were driven by the urgency of finishing the Interstate System by the early 1970s and by visions of the benefits the Nation, particularly cities, would enjoy when it was completed. The highway officials and urban political leaders did not foresee that, in their pursuit of "radical revision," they were exposing America's racial divides and contributing to the problems their successors would confront in coming decades.

Beauty for America

In November 1964, the American people gave President Johnson a landslide victory over Senator Barry Goldwater (R–AZ). During the campaign, the President's wife, Lady Bird Johnson, had complained to her husband about the roadside junkyards they saw along the way. He revealed her views during remarks on conservation in Portland, OR, on September 17, 1964. The auto junkyards they had seen during the campaign, he said, "are driving my wife mad." He said he intended to "develop a national policy for the control and disposal of technological and industrial waste."

As *U.S. News & World Report* explained, the President's references to the subject during the campaign

prompted applause, so "the President observed: 'If it's beautifying they want, it's beautifying they'll get.'"

On February 8, 1965, within 3 weeks of renewing his oath of office, President Johnson wrote to Congress on stewardship of the country's natural bounty. "It would be a neglectful generation indeed, indifferent alike to the judgment of history and the command of principle, which failed to preserve and extend such a heritage for its descendants." The modern highways that "may wipe out the equivalent of a 50-acre [20-hectare] park with every mile" were one of the culprits. Recognizing that "ours is an automobile society," the President did not want to curtail roads. He wanted to make roads the "highways to the enjoyment of nature and beauty."

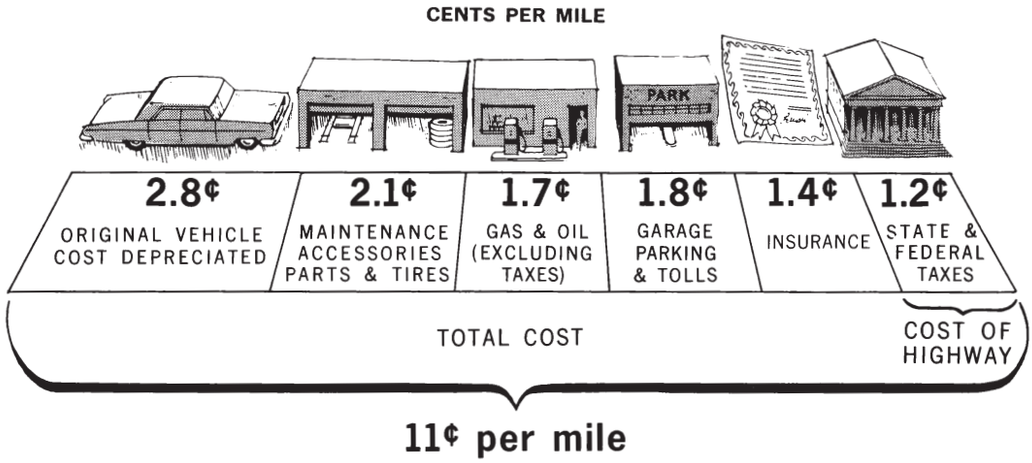
He called for "a new conservation" that would protect the countryside, restore "what has been destroyed," and "salvage the beauty and charm of our cities." He was not, he said, referring to the "classic conservation of protection and development, but a creative conservation of restoration and innovation." His creative conservation included proposals for cities, rivers, and trails, as well as ideas for curbing pollution.

President Johnson planned several highway initiatives. He had directed Commerce Secretary John T. Connor, who had taken over for Secretary Hodges in January 1965, to ensure that landscaping would be part of all Interstate and Federal-aid primary and urban highways. Johnson also planned to introduce legislation on effective control of billboards and "unsightly, beauty-destroying junkyards and auto graveyards along our highways."

He also called a White House Conference on Natural Beauty for May 24–25 in Washington, DC. BPR's Whitton told a conference panel that "highways are for people," a message he would repeat on many occasions. "The highways must be beautiful as seen from the driver's seat…and they also must not be a scourge on the community through which they pass." To accomplish this goal, he urged cooperation among Federal, State, and city officials as well as use of "every skill that is available," including "the skills of architects, landscape architects, highway engineers, and psychologists and all the others" to create "the best possible transportation system and the best possible urban plan for our cities."

The President's America the Beautiful initiative proved controversial when the rights of private property owners clashed with public interests. Billboards, for example, had been criticized for decades, but controlling their use had proven difficult. The Federal-Aid Highway Act of 1958 had declared that control of outdoor advertising was "in the public interest." It had authorized a bonus program, with the revenue coming from the general Treasury rather than the Highway Trust Fund, under which States would receive a 0.5-percent increase in the Federal share of Interstate construction costs if they agreed to control outdoor advertising. However, by 1965, only 20 States, with one-fourth of Interstate System

President Johnson signed the Highway Beautification Act of 1965 on October 21. The first billboard, on I–95 near Freeport, ME, came down under the act in April 1971. Secretary of Transportation John A. Volpe addresses reporters and area residents in front of the first billboard to be torn down.



BPR used this 1966 graphic to put the cost of highways in perspective and allay public displeasure. As BPR explained here, State and Federal highway taxes represented only 1.2 cents of the total 11 cents per mile it cost to operate an automobile back then. The figures were based on a $2,800 car driven 100,000 miles over 10 years.

mileage within their borders, had entered into bonus agreements.

Given this limited success, one of the most prominent results of the President's beauty initiative was passage of the Highway Beautification Act of 1965. The signing ceremony took place at the White House on October 22, the day after the President returned from surgery at Bethesda Naval Hospital. Recalling the ride from the hospital along the George Washington Memorial Parkway, the President said, "not one foot of it was marred by a single unsightly manmade obstruction—no advertising signs, no junkyards. Well, doctors could prescribe no better medicine for me." Saying "beauty belongs to all the people," he signed the bill and gave the first pen to Lady Bird, along with a kiss on the cheek.

The billboard portion of the law required States to provide effective control of outdoor advertising along the Interstate System and primary system highways. For States that did not do so, their Federal-aid apportionment could be reduced by 10 percent. Some signs would be permitted, namely directional and other official signs, signs and other devices advertising activities conducted on the property on which they were located, and signs marketing the sale or lease of the property on which they were located. The Commerce Secretary was to enter into an agreement with each State regarding the size, lighting, and spacing, consistent with customary use, on outdoor advertising.

Signs that did not comply with the new requirement were to be removed after July 1, 1970, with just compensation for those that had been erected legally before enactment of the law. The act authorized $20 million per year for FY 1966 and 1967 for this purpose, with the funds coming from the general Treasury, not the Highway Trust Fund, and a Federal share of 75 percent.

To promote the safety and recreational value of travel and preserve natural beauty, the law also required effective control of outdoor junkyards along the Interstates and primary system highways. Effective control meant screening by natural objects, plants, fences, or other means, with a 10-percent penalty on apportionments for States that did not comply. The Federal share of junkyard screening projects was 75 percent, again with $20 million per year from the general Treasury.

The first billboard did not come down until April 1971, when a sign in a pine grove off I–95 near Freeport, ME, was removed. Transportation Secretary John A. Volpe said, "Take her down, boys," as a crane pulled the facing off the billboard, which had most recently advertised a restaurant and a music store.

The Web of Union

A year after launching the conservation initiative, President Johnson announced in his State of the Union Address in January 1966 that a U.S. Department of Transportation (USDOT) was needed. With 35 Government agencies spending $5 billion a year on transportation, he said, the "present structure makes it almost impossible to serve either the growing demands of this great Nation or the needs of the industry, or the right of the taxpayer to full efficiency and frugality."

On March 2, President Johnson submitted legislation to Congress. "In a Nation that spans a continent," he wrote in an accompanying message, "transportation is the web of union." The "tenuous skein of rough trails and primitive roads" of the Nation's early years had become "a powerful network on which the prosperity and convenience of our society depend." He urged creation of a USDOT "to serve the growing demands of this great Nation, to satisfy the needs of our expanding industry, and to fulfill the right of our taxpayers to maximum efficiency and frugality in Government operations."

BPR would be part of the new Department, but the Housing and

Home Finance Agency, which administered the Urban Mass Transportation Act of 1964, would remain in the Department of Housing and Urban Development (HUD), its home since September 1965. The President said that after creation of USDOT, he would ask the new Secretary of Transportation to work with the HUD Secretary to submit proposals on "a unified Federal approach to urban problems."

President Johnson signed the Department of Transportation Act in October 1966 before about 200 guests at the White House. The new law brought together 31 agencies and bureaus; BPR had by far the largest budget, $4.4 billion, in a Department with a total budget of $6.6 billion. "In large measure," the President said, "America's history is a history of her transportation." Although the transportation system "is the greatest in the world," he added, "we must face facts. It is no longer adequate." He described his vision that "a day will come in America, when people and freight will move through this land of ours speedily, efficiently, safely, and dependably."

The President selected Alan S. Boyd to serve as the first Transportation Secretary. A 44-year-old lawyer, Boyd had been general counsel of the Florida Turnpike Authority and chairman of the Florida Railroad and Public Utilities Commission before President Eisenhower appointed him to serve on the Civil Aeronautics Board. Boyd became chairman of the board in 1961 and was appointed Under Secretary of Commerce in 1965. President and Mrs. Johnson watched on January 16, 1967, as Boyd took the oath of office as Transportation Secretary in the East Room of the White House. The President explained that Boyd would "coordinate a national transportation policy for this great land of ours…and give the kind of results that the American people would like to point to with pride."

Administrator Rex Whitton Takes His Leave

By the time Rex Whitton resigned at the end of 1966, he had addressed the problems that had faced the National System of Interstate and Defense Highways when he took office. By cooperating with the Blatnik Committee and strengthening BPR oversight, Whitton had helped put to rest the scandals that had given critics of "the highway bungle" their strongest, most visible weapon. The Federal-Aid Highway Act of 1961 put the program on a sound financial footing that would carry it through the early 1980s.

The most remarkable transformation had come in response to the objections on social and environmental grounds. Initially, Whitton and the road-building community were convinced that these issues could be addressed with public relations initiatives such as National Highway Week. Although Whitton and his successors would continue to stress the positive aspects of the program, he was, in effect, the bridge between those who thought the benefits of the Interstate System trumped other considerations and those who would embrace the growing number of environmental laws and the stewardship they demanded.

In February 1966, moreover, BPR announced that the States had met Whitton's challenge to AASHO by opening more than half of the Interstate System. With the unveiling of 3,486 kilometers (2,166 miles) in 1965, open mileage totaled 34,094 kilometers (21,185 miles), or 52 percent, of the 65,980-kilometer (41,000-mile) system. Construction was underway on another 8,980 kilometers (5,580 miles); only 4,634 kilometers (2,880 miles), or 7 percent, of the system had not yet advanced beyond preliminary status. Approximately $24.7 billion had been put to work on the Interstate program.

In November 1966, Whitton was in Wichita, KS, for his final presentation to AASHO during its annual meeting. Noting that 1966 was the 50th year since creation of the Federal-Aid Highway Program

When the Federal Highway Administration began operating on April 1, 1967, it was organized into bureaus. Secretary of Transportation Alan S. Boyd (left) administered the oath of office to longtime career employee Francis C. "Frank" Turner as director of the Bureau of Public Roads.

in 1916, he told his colleagues, "The first 50 years are the easiest," and as for the future, he said, "You ain't seen nothing yet."

With urban populations increasing, he said, the main thrust of highway efforts "should be directed to easing the plight of cities." Whitton also emphasized the desirability of "making highway transportation compatible with the environment while serving many urban needs." Highways, he said, cannot be isolated from other forms of transportation. "We must plan transportation *systems*. We cannot afford to do any less." This is why the new USDOT "makes sense—from any viewpoint, but particularly with respect to the close and efficient coordination of Government programs for the entire transportation system."

The one negative Whitton discussed involved displacements and relocations. Only 32 States were paying moving costs, "and far too few States are doing an outstanding job in providing the basic assistance required." If more States do not offer assistance voluntarily, it will become mandatory, he said. (Just such a Federal law, the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, would be enacted a few years later.)

Whitton concluded: "I have been around long enough . . . to have confidence that our highway program is not frozen by tradition, that it has not only resiliency but also the flexibility needed to respond to any new challenge. And I have confidence that its response, that your response, that the response of the highway engineer, will be more than adequate to what our Nation expects and deserves—and that, gentlemen, is a lot."

In December 1966 a retirement ceremony was held in the General Services Administration auditorium "filled to overflowing with the hundreds of associates and employees of Mr. Whitton," according to BPR's newsletter. Secretary-designate Boyd presented the Commerce Department's Gold Medal to Whitton "for exceptional achievements as a leader in highways and highway transportation in the United States, and contributions to these same interests worldwide."

A New Department Takes Off

The USDOT opened for business on April 1, 1967. On the National Mall, Secretary Boyd joined with the Smithsonian Institution in celebrating the opening ceremonies of a spring gala dubbed the "Pageant of Transportation." After a news conference during which he introduced Department leaders, Boyd pledged that the new agency would work to make transportation more efficient and more socially responsible. In a remark that seemed directed at the Interstate System, he added, "We want an end to the noise, pollution, and general disfigurement transportation has unintentionally brought to our cities."

The opening of the new Department meant changes for BPR. One involved its name. "Bureau of Public Roads" had been used during two periods of the agency's history spanning 39 years, with "Public Roads Administration" being the interim name. On April 1, 1967, the agency became the Federal Highway Administration (FHWA). The newly renamed agency was organized into bureaus headed by directors, with the BPR name retained for one of them, along with the Bureau of Motor Carrier Safety (now the Federal Motor Carrier Safety Administration) and the National Highway Safety Bureau (now the National Highway Traffic Safety Administration). With the additions, the agency increased from about 4,800 employees at the end of 1966 to 5,360 employees a year later. (In August 1970, FHWA eliminated the bureau structure, replacing the directors with associate administrators and finally ending use of the name BPR.)

The director of BPR was Francis C. "Frank" Turner, who had joined BPR in 1929 after graduating from Texas Agricultural and Mechanical College (now Texas A&M University). In the 1950s he had played a key role in the committee established by President Eisenhower and headed by retired General Lucius D. Clay to develop a national highway plan, and had served as liaison between BPR and the key committees in Congress during development of the Federal-Aid Highway Act of 1956. (In February 1969 he became the only career employee to become Federal Highway Administrator.)

Perhaps the most surprising change was that the first person to hold the title of Federal Highway Administrator in the new department would not be an engineer. Lowell K. Bridwell had been a journalist throughout his career, most recently as the top writer on highways for the Washington bureau of Scripps Howard Newspapers. He had joined the Commerce Department in April 1962 as assistant to Transportation Under Secretary Clarence Martin, Jr., and held other Commerce posts over the next 5 years. He would take office as Federal Highway Administrator in March 1967 and hold the position until the end of the Johnson Administration, January 20, 1969.

Pioneer of Modern Highway Construction

After leaving BPR, Rex Whitton returned to Kansas City, MO, where he accepted a position as consultant to the engineering firm of Howard, Needles, Tammen & Bergendoff. He retired in 1975. The following year he told *FHWA News*, the agency newsletter, that he and his wife enjoyed driving to auction sales for antiques. However, they avoided the freeways he had helped to build. He never liked driving on them, he said, and now enjoyed "driving on the little back roads, keeping a map of each one we travel."

Rex Whitton passed away at age 82 on July 7, 1981, after a long illness. The passing of the man who had rescued the Interstate System was little noticed around the country. However, an obituary in *AASHTO Quarterly* noted, "His national reputation as a pioneer of modern highway construction not only brings honor to his memory, but also to a profession he dearly loved."

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For more information on the early days of the Interstate System, visit www.fhwa.dot.gov/interstate/homepage.cfm or www.fhwa.dot.gov/infrastructure/history.htm.

FHWA turns to the information highway to help reduce truck congestion on the Nation's roadways.

by Joanne Sedor and Michael Onder

A High-Tech Route for Freight Efficiency

According to the Federal Highway Administration's (FHWA) recently released report *Freight Facts and Figures 2005* (FHWA-HOP-05-071), international trade is growing faster than the overall U.S. economy. Between 1980 and 2003, the U.S. economy, measured by gross domestic product (GDP), doubled, while foreign trade quadrupled in real value, reflecting unprecedented global connectivity. Ocean, rail, and air carriers use trucks and highways for some component of almost every shipment. Already tight infrastructure capacity will be stressed further by limited new construction and the growing demand from freight transportation. In fact, the FHWA Freight Analysis Framework indicates that by 2020 freight volumes will increase by 70 percent from 1998 totals, and freight volumes through the Nation's primary gateway ports could more than double. Finding ways to improve the operational efficiency of moving this freight is critical to the Nation's economic vitality and global connectivity.

(Above) With freight volume on U.S. highways expected to increase by 70 percent over 1998 levels by 2020, Electronic Freight Management (EFM) can help reduce congestion, such as the gridlock shown in this photograph, by better coordinating intermodal connections.

Officials at the U.S. Department of Transportation (USDOT) recognize that moving freight involves moving information as well as the goods themselves. Although excellent information management can increase freight efficiency, poor information management can add costs, slow handoffs, open security gaps, create delays at gates, and even lead to erroneous freight movements.

Given the important and growing role that goods movement plays in the U.S. economy and the impact that it has on the transportation network, USDOT's Intelligent Transportation Systems (ITS) Joint Program Office and FHWA recently launched the Electronic Freight Management (EFM) project. EFM aims to improve the "information highway" that moves critical business information and facilitates the multimodal movement of airfreight, generating benefits for both private and public stakeholders. In particular, the project addresses weaknesses in freight data exchange processes that add costs, create security gaps, and, over time, contribute to congestion.

"It is well accepted that technology systems and electronic data represent one of the few remaining tools for improving both productivity and security," says Margaret Irwin, director of customs and cross-border operations for the American Trucking Associations. "In addition, regulatory costs can be successfully managed in the long term only by replacing labor-intensive paperwork with electronic systems. Given that international trade now represents 25 percent of our country's GDP, it is particularly important for ports and borders to operate more efficiently."

EFM advances several concepts, but the single key concept is to promote electronic data exchanges along a supply chain in an end-to-end manner more robustly than is currently being done. Typically, freight movements are supported by point-to-point communications, either paper-based or electronic, between parties who agree to such communications. Using the Internet to make data available broadly to any authorized and authenticated user in near real time is key to enabling freight transportation networks to operate more efficiently and securely. This type of data exchange

provides buyers and other authorized parties with open visibility into supply chains. Program officials expect that these improvements will help to reduce unnecessary traffic on the transportation network and mitigate congestion.

Defining the Approach

The EFM project builds on previous USDOT and industry-sponsored operational tests that used biometric smart cards and electronic data exchange to move freight more efficiently and securely.

Earlier tests were limited to domestic freight data, but the EFM project will be broader, covering international data standardization and offering more robust Web services to support the information highway for airfreight shipments. (See "Brief History of Freight Management Initiatives" and "Intermodal Freight Technology Working Group" on pages 40 and 42, respectively.)

One goal is to address known shortcomings in managing freight information, such as incompatible data standards or having to retype data from one electronic system to another. Other goals include testing new approaches and processes and facilitating the real-world deployment of best practices.

The EFM project also includes a separately funded independent assessment to ensure that test objectives are credible and that the results are measurable. "Independent assessments are a critical part of every USDOT field operational test," says Kate Hartman, freight coordinator in USDOT's ITS Joint Program Office. "By policy and design, USDOT funds and supervises assessments outside the project channels to ensure that the results are not only independently verified but also are perceived as credible and useful to public and private stakeholders."

Biometric smart cards, like the ones shown here, contain information on the truck driver, including a photocopy of a commercial driver license and the driver's thumbprint. This information (contained in the gold-colored chips) is used to expedite the movement of cargo through intermodal transfer facilities and trucks through border crossings. *Photo: American Trucking Associations Foundation.*

An independent assessment also will help document the successes and shortcomings of the project and provide a framework for replicating similar tests in other locations and with other supply chains.

Through the EFM project, USDOT is partnering with business and industry to conduct operational tests in international airfreight movement. Industry partners are Limited Brands, a shipper of apparel and personal care items based in Columbus, OH; freight forwarders Hellmann Worldwide Logistics and StarTrans International, Ltd.; customs broker Barthco International, Inc.; trucking company ODW Logistics, Inc.; and several airlines that deliver goods from China to the United States, including Evergreen and Atlas Air. All of these partners support the use of information technologies to improve productivity. Other stakeholders supporting the project and providing advice and guidance are the American Trucking Associations, the Air Transport Association, and the International Air Transport Association (IATA).

Striving for International Data Standards

Another component of the EFM project involves working with

Brief History of Freight Management Initiatives

1996—The White House Commission on Aviation Safety and Security cites air cargo security as a problem needing attention.

1997—The Federal Aviation Administration (FAA) awards a research grant to the American Trucking Associations Foundation (predecessor to the American Trucking Research Institute) to develop and test a biometric smart card access system for truck drivers delivering air cargo to Chicago's O'Hare International Airport. The system shows strong promise for identifying and managing driver, company, and cargo information. Data from Phase 1 of this project are available by contacting Michael Onder at 202–366–2639, michael.onder@fhwa.dot.gov.

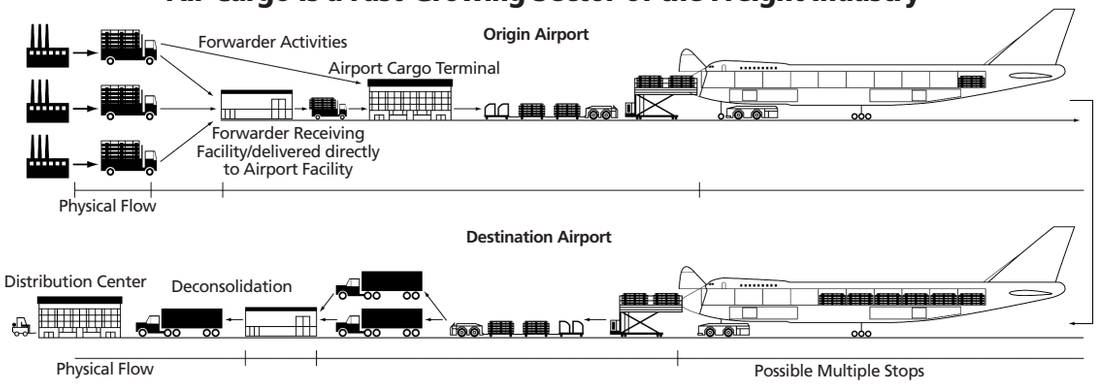
2000—FAA and FHWA sponsor an expanded Phase 2 operational test called the Electronic Supply Chain Manifest (ESCM) initiative. The test integrates biometric smart cards with a secured Internet-based cargo transaction system and conducts operations at airports in Chicago, Los Angeles, New York, and Toronto. Despite project delays after the 9/11 attacks, an independent assessment confirms that ESCM improves both supply chain security and productivity for participating manufactures, truckers, and airlines. The evaluation of Phase 2, dated 2002, is available at www.ops.fhwa.dot.gov/freight/intermodal.

2004—USDOT expands the ESCM concept to include international data standardization and more robust Web services to support the information highway for airfreight shipments. FHWA takes the lead in a data standardization project with the International Organization for Standardization. USDOT includes the expanded EFM project on its list of nine "Tier 1" strategic initiatives and moves ahead with a real-world test. USDOT hires a contractor to design and manage an operational test of supply chain transactions between a major U.S. apparel and personal care products corporation and its international supply chain partners.

2005—The EFM research team submits its preliminary design report, and the independent assessment team prepares its preliminary evaluation plan.

2006—The EFM team submits the final design and begins deployment testing.

Air Cargo Is a Fast-Growing Sector of the Freight Industry



Limitedbrands
LOGISTICS SERVICES

As a major participant in the EFM project, Limited Brands and its partners form a supply chain that includes a manufacturer, customs broker, two freight forwarders, two air carriers, and a logistics trucking company.

national and international standards organizations to ensure that data exchanged between trading partners and government agencies are interoperable in all systems. Several years ago the world's standards community—the International Organization for Standardization, the International Electrotechnical Commission, the International Telecommunication Union, and the United Nations Economic Commission for Europe—formed a consortium for electronic business and signed a memorandum of understanding to cooperate in, among other things, the development of "message and interoperability standards for business transactions."

At the IATA e-Freight Conference in November 2005, IATA Director General and CEO Giovanni Bisignani echoed the need for standards for exchanging data in a worldwide marketplace. "I urge the industry to develop plans, set aside funds, and identify the resources needed to realize e-freight in your companies," Bisignani said in his keynote address. "I urge governments and customs authorities to harmonize requirements we desperately need for a global solution. Most important, we must work together as a team. And we must move fast."

The early development of standards for universal business language (UBL) focused on business processes related to purchasing and finance. The latest standards include transportation data messages that could help eliminate the expensive translation costs that the U.S. freight industry incurs in order to interact with industries in Europe and Asia.

"The EFM project is recognized as a helpful catalyst in developing data standards and moving development and implementation along the path of adoption," says Jon Bosak, chairman of the UBL Technical Committee of the Organization for the Advancement of Structured Information Standards (OASIS).

Public Sector Benefits

USDOT officials recognize that an efficient freight sector is not only vital to the prosperity and competitiveness of the United States in the global marketplace, but it also relates directly to public concerns about mobility, congestion, and security. "The public benefits of an efficient freight sector have a direct link to the cost of goods, less vehicle emissions, and less congestion" says Michael Wolfe, a freight transportation consultant with the North River Consulting Group.

Adopting EFM best practices also promises to help mitigate congestion and reduce air emissions typically associated with idling trucks and passenger vehicles. Currently, most physical handoffs of freight goods from one mode to another, or within modes, occur at terminal yards and seaports near major metropolitan areas. Traffic congestion already is a major problem in many of these urban areas, and freight movement is both affected by and affects that congestion. "That's an important reason to pursue EFM technologies and best practices, which not only address private sector business issues but also help mitigate the congestion issues that continually perplex public officials," says Wolfe.

To the extent that better data translate into better shipment visibility and control, EFM technologies can enable tighter planning for intermodal exchanges. That, in turn, could enable tighter handoff windows for goods, reducing engine idling at gates and during wait times and decreasing unnecessary vehicle trips. This reduces energy consumption and engine emissions.

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EFM can help reduce congestion in air terminals, such as the air cargo consolidation center (shown here) at O'Hare International Airport in Chicago, IL, and decrease erroneous and duplicative shipments that can lead to highway congestion.

Security Benefits

Accurate shipping data also enhance transportation security. From the public sector's perspective, accurate and timely data enable effective prescreening of import shipments for security-related anomalies. Datasets that include linkage of cargo, truck, and driver information provide more effective terminal access controls, as shown in previous FHWA studies such as the Electronic Supply Chain Manifest (ESCM) operational test. The ESCM test involved integrating biometric smart cards with a secured Internet-based cargo transaction system at selected U.S. airports. More accurate data help to reduce security risks by providing a more accurate audit trail to help public and private sector security personnel answer questions, track down anomalies, and respond to incidents, thereby instilling greater confidence in the transportation network.

There is another, indirect security benefit. Security experts generally agree that "freight at rest is freight at risk" and that congested or disorganized operations are more susceptible to security incidents than well-organized and efficient operations. To the degree that better data—such as that generated by EFM—enhance efficiency and improve operational control, they also reduce security risks.

According to Mike Sherman, vice president of global transportation for Limited Logistics Services, Inc., "The EFM initiative is interesting because its objective is to enhance supply chain security by leveraging new technology and creating standard industry protocols for information exchange that capture all relevant information about events in the supply chain lifecycle. If our compelling need for enhanced supply chain security can drive to a common standard for comprehensive and flexible information exchange, not only will security compliance be greatly enhanced, but also the operational and administrative efficiency and flexibility of the supply chain."

American Trucking Associations Foundation

The EFM project focuses on improving planning efficiency between truck transportation and airfreight carriers such as this plane.

He adds, "This is a daunting challenge given the number of traders in the global supply chain, not to mention the number of regulatory authorities with an interest in the solution—each, perhaps, with their own point of view. I believe shippers, carriers, and other supply chain partners want to do everything necessary to be secure and compliant, but they will not invest in a solution unless they are certain it will satisfy the future requirements of regulatory agencies. A consensus view on requirements from the U.S. Customs Service, the Transportation Security Administration, the U.S. Department of Homeland Security—and perhaps international authorities, since this should be addressed with a global perspective—will be an important element of commercializing EFM as a long-term solution."

Benefits for the Private Sector

Shifting focus to the private sector, the benefits are more easily quantifiable. An independent assessment of the earlier operational test, the ESCM project, reported results that helped generate industry enthusiasm for the EFM initiative. As reported in the *Electronic Intermodal Supply Chain Manifest, Freight ITS Operational Test Evaluation, Final Report* in December 2002, ESCM delivered meaningful labor cost savings and time-on-task reductions in manifest preparation, paperwork handling, communication with up- and downstream partners, as well as the actual load transfer times. Much of the cost savings in labor was related to eliminating the need for inputting data late in the shipping process, as critical data are entered early on.

The ESCM project reported a potential time and labor savings of

Intermodal Freight Technology Working Group

The Intermodal Freight Technology Working Group (IFTWG) is a public-private partnership focused on identifying and evaluating technology-based tools to improve the efficiency, safety, and security of intermodal freight movement. The group works to marry industry and government priorities in ways that leverage collective experience and shared investment. "Through IFTWG, government and industry have developed an important element of trust, collaborating on solving problems of mutual concern to benefit both the public and private sectors," says Tony Furst, director of the FHWA Office of Freight Management and Operations.

IFTWG's goal is to examine promising technological options that address real-world challenges and to transfer that knowledge into the hands of transportation stakeholders. IFTWG members have helped shape the evolution of EFM since 1998, when the idea was conceived at a workshop on freight identification technology.

An official from USDOT's Office of Intermodalism in the Research and Innovative Technology Administration and a representative from the transportation company Union Pacific cochair IFTWG. The group holds regular Web-based conferences and meets twice a year in conjunction with Intermodal Association of North America conferences. Participation is open to those who have a genuine concern for the long-term health of the intermodal freight transportation system and a willingness to engage in collaborative problem solving.

For further information, contact Randy Butler in FHWA's Office of Freight Management and Operations at 202–366–9210, randy.butler@fhwa.dot.gov.

$16.20 per nonexpress airfreight shipment. This figure includes two components: (1) *measured* cost savings based on data collected for the pickup side of the supply chain ($11.77 per shipment) and (2) *estimated* cost savings for the delivery side of the supply chain. "Given the relatively small size of most airfreight shipments, especially when compared to truckload highway shipments, $16.20 per shipment is a meaningful savings," says Dan Murray, vice president of research for the American Transportation Research Institute.

Recent conversations with freight forwarders and third-party logistics providers indicate that enhanced access to freight data from electronic information exchange could improve operations themselves via better preplanning of cargo handling and also could enable shippers to improve customer satisfaction with more accurate and timely handling of tracking and tracing requests.

Jeff Clark, vice president of sales and marketing at ODW Logistics, Inc., says that participation in the EFM project has enhanced his company's focus on customer satisfaction. "In an international trading world that is very paper intensive, this electronic system is more visible, creating a more efficient, highly accessible, and expeditious outcome," he says. "We have the information when we need it to be proactive with our customers in planning for both people and equipment resources, which will shorten the supply chain—and ultimately reduce costs in the long run."

Moving Forward With EFM

Design for the EFM deployment test began in January 2006, and FHWA expects to begin building out the design by the fall of 2006. Deployment is expected to start in January 2007 and will be completed by the summer of 2007. An independent evaluation conducted in parallel with the test will be completed by the summer of 2007. Pending the results of this test, supply chains involving other modes, for example, truck-rail and truck-ship, also could be included in future deployment tests.

First, however, it is critical that EFM concepts and best practices reach airfreight stakeholders in order to realize maximum benefits and to continue on without direct Government collaboration. "Without a doubt, the success of the project is measured by the Government's ability to facilitate the adoption of EFM best practices and the airfreight industry's implementation of them," says Tony Furst, director of FHWA's Office of Freight Management and Operations.

FHWA officials believe that it is critical to collaborate with industry to move toward the goal of adopting EFM concepts and best practices, even before the test is concluded and the results are in. Waiting to publish measured benefits before discussing why market leaders should already be involved in the test may unnecessarily delay adoption for other industries. Therefore, in parallel to the EFM test, FHWA's Office of Freight Management and Operations is developing a phased marketing plan to promote adoption of EFM candidate best practices.

Critical to this marketing plan is raising awareness within segments of the industry that may have an interest in adopting EFM concepts and best practices to allow them sufficient time to prepare business plans and organize partners. Another FHWA goal is to facilitate adoption of best practices and to guide implementation. FHWA will gauge interest based on the awareness campaign and the number of companies signing up for guidance. If the interest is positive, which would indicate the potential for significant market penetration, then the next deployment test would involve maritime and rail interests. This collaboration between government and industry could then signify a sea change in how intermodal freight is handled domestically and globally in the future.

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Better planning through EFM can lead to reduced truck engine idling and wait times at cargo terminals such as this one at the Port of Oakland, CA.

Joanne Sedor is a transportation specialist in FHWA's Office of Freight Management and Operations. As a member of the Freight Policy and Communications teams, she analyzes freight issues and trends and writes about them in publications. Prior to joining FHWA in 2001, Sedor was a senior analyst and project manager at the Congressional Office of Technology Assessment.

Mike Onder is the FHWA team leader for freight operations and technology. He oversees industry partnerships that conduct intermodal freight operational tests to determine the effectiveness of technology and information standards in freight mobility. Before joining the Office of Freight Management and Operations, he served as the ITS program manager for commercial vehicle operations and intermodal freight with USDOT's ITS Joint Program Office.

FHWA's Office of Freight Management and Operations, in coordination with USDOT's ITS Joint Program Office, manages the EFM project. For more information, please contact Michael Onder at 202-366-2639, michael.onder@fhwa.dot.gov, or Kate Hartman at 202-366-2742, kate.hartman@fhwa.dot.gov.

Gearing Up for an Aging Population

by Jane Stutts and Ingrid Potts

A new guide aims to improve driving safety for older road users.

Increasing the safety of older road users, such as this driver and passenger, is the goal of NCHRP's guide for older drivers. *Photo: NHTSA.*

According to a June 2002 article in BMJ Publishing Group's *Injury Prevention* journal, Stephen Lyman and coauthors project that aging baby boomers will have a profound effect on the safety of the Nation's roadways, comprising up to one-fourth of all traffic fatalities by the year 2030. There are a number of reasons for focusing on older drivers, not all of which are readily apparent from a superficial examination of crash statistics.

Based purely on crash rates per licensed driver, older adults are some of the safest drivers on the roadway, and their crash rates have not shown dramatic increases over the past decade. The picture changes, however, when the rates are calculated based on miles driven rather than on licensed drivers. And when the attention also shifts to fatalities rather than crashes or injuries, there is even greater cause for concern. While there is an overall national average of 1.44 fatalities per 100 million vehicle miles traveled (MVMT), drivers over the age of 75 have a fatality rate of 3.7 deaths per 100 MVMT. And those over the age of 85 have a fatality rate of 8.0 deaths per 100 MVMT, according to Tony Kane, director of engineering and technical services at the American Association of State Highway and Transportation Officials (AASHTO).

Given the national goal—adopted by AASHTO, the U.S. Department of Transportation (USDOT), and others—of lowering the national highway fatality rate from 1.44 to 1.0 per 100 MVMT by the year 2008, Kane says, "These are disturbing numbers, especially when one considers the large projected increase in the number of older drivers on our roadways." He notes that the Nation's population not only is aging but also comprises greater numbers of older adults continuing to drive into their 80s and beyond. These seniors are making more trips and driving more miles.

In the *Injury Prevention* article cited earlier, Lyman and his coauthors echo Kane's concerns. The authors conclude, "Because older vehicle occupants will comprise a large proportion of future deaths in motor vehicle crashes, public health efforts to reduce their morbidity and mortality should be pursued." Factoring the baby boomer trend into the equation will in all likelihood multiply the challenges to be addressed in reducing the fatality rate.

To help State departments of transportation (DOTs) meet the goal for reducing the national highway fatality rate, the Transportation Research Board's (TRB) National Cooperative Highway Research Program (NCHRP) published a series of guides for improving highway safety called *NCHRP Report 500: Guidance for Implementation of the AASHTO Strategic Highway Safety Plan* (NCHRP Report 500). One volume of this series is *NCHRP Report 500, Volume 9: A Guide for Reducing Collisions Involving Older Drivers* (guide). The guide recommends planning strategies for improving the roadway and driving environment to better accommodate older drivers, identifying high-risk older drivers and intervening to lower their crash risk, improving the driving competency of older adults in general, and reducing the risk of injury and death to older occupants involved in crashes.

Debunking Myths About the Older Driver

U.S. adults age 65 and older comprise a rich, diverse, and engaged mix of individuals. Events such as the recently concluded White House Conference on Aging celebrate that diversity and the multifaceted contributions of older adults to their communities. Yet standing in stark contrast to that portrait are various misconceptions about these same people once they get behind the wheel. Continuation of such myths stymies efforts of law enforcement, medical professionals, families, and even older adults themselves to face proactively what in most instances is the eventual transition from driving full time to stopping driving altogether. Consider two examples:

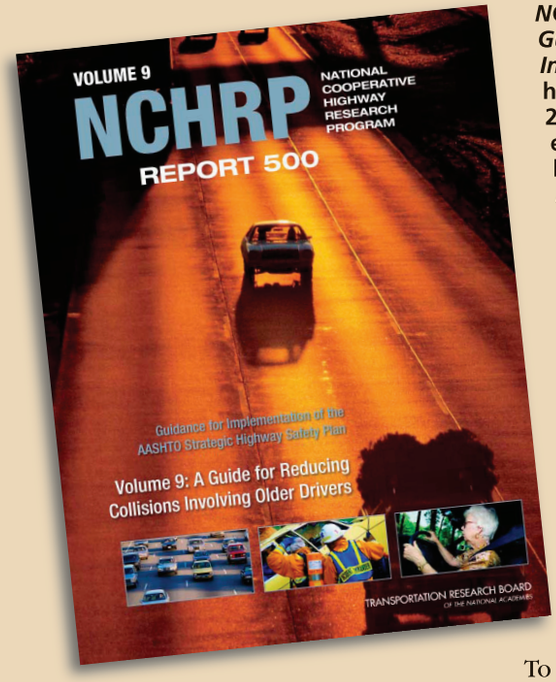
Myth 1: Aging is associated with inevitable functional declines that make most older adults high-risk drivers.

Fact: This myth is the underpinning for calls by some pundits and lawmakers for States to enact mandatory age-based testing of older drivers. Although specific abilities needed to drive safely may decline as a person ages, the rate of change varies greatly among older adults. Many older people do not differ significantly in their driving skills from middle-aged people, who statistically are the safest group on the road. Older drivers have the highest rate of seatbelt use and lowest rate of alcohol-related crashes. In addition, most self-regulate their driving through a variety of actions such as not driving at night. What is less clear is whether they make those changes at the right time and in the right way; many individuals who experience cognitive decline often lack insight into their loss of function.

Myth 2: Older adults can get around using public transportation once they limit or stop driving.

Fact: Many public transportation systems, especially those offering only fixed-route bus service, are poorly equipped to meet the needs of older adults for responsive, convenient transportation. Nationally, less than 3 percent of older adults now look to public transportation for getting around their communities, though in some major metropolitan areas the figure is significantly higher. Still, many older adults have little experience with and confidence in public transportation. Older people are generally more likely to be able to operate their own cars, parked at their homes, than to use fixed-route transit, that is, walking a few or many blocks to the bus stop, waiting for a bus, and making that final big step to get onto the bus. An increasing number of communities are developing transportation choices that are more flexible than traditional fixed-route public systems, offering on-demand, door-to-door or door-through-door service.

Jeff Finn, American Society on Aging



***NCHRP Report 500, Volume 9: A Guide for Reducing Collisions Involving Older Drivers,* shown here, was published in late 2004 and is also available electronically on the Web at http://trb.org/publications/nchrp/nchrp_rpt_500v9.pdf.** *Source: TRB.*

No single agency or organization could accomplish the strategies in these areas on its own. Rather, a coordinated effort is needed that involves partnerships across agencies and organizations in both the public and private sectors.

The Older Drivers Guide and AASHTO's Highway Safety Plan

In 1997, the AASHTO Standing Committee on Highway Traffic Safety, along with the Federal Highway Administration (FHWA), the National Highway Traffic Safety Administration (NHTSA), and the TRB Committee on Transportation Safety Management, convened a meeting of national transportation safety experts to develop a comprehensive highway safety plan for the Nation. The goal was to address not only roadway and infrastructure needs but also drivers and other roadway users, vehicles, emergency medical services, and the traffic safety management process. Its success was to be measured by the number of lives saved.

The AASHTO Strategic Highway Safety Plan (SHSP)—developed by AASHTO, FHWA, NHTSA, and TRB, with the participation of many others—evolved from the meeting and identified 22 emphasis areas where coordinated actions could substantially reduce traffic fatalities and injuries. "Sustaining Proficiency in Older Drivers" was one of the priorities included in the plan.

To assist States in implementing the SHSP recommendations, the NCHRP (a State pooled fund program managed by TRB in cooperation with FHWA) funded a project to develop guides for each of the 22 priorities. Collectively, the guides form NCHRP Report 500. Each guide provides background information and data on the given priority, along with recommended objectives and strategies for addressing the problem. The report indicates that the "development of the volumes of NCHRP Report 500 used the resources and expertise of many professionals from around the country and overseas. Through research, workshops, and actual demonstration of the guides by agencies, the resulting documents represent best practices in each emphasis area."

"We encouraged developers of the guides to identify countermeasures that were practical for States to implement and that had either been formally evaluated and proven effective or had been tried with promising results," says Tim Neuman, overall director for the CH2M Hill team conducting the project. "State and local officials should be able to put these guides to immediate use in reducing crashes and saving lives."

All of the guides in NCHRP Report 500 follow a similar format. For each of the identified strategies, there is a brief description and rationale for the strategy, followed by a table detailing the technical and organizational attributes needed to implement it. Examples include the strategy's expected effectiveness, keys to success, potential difficulties, appropriate measures and data, and associated needs for support services. Each table also provides information on organizational, institutional, and policy concerns; expected costs; issues affecting implementation time; training and personnel needs; and legislative requirements. Finally, an effort is made to identify agencies or organizations currently implementing the strategy so that others might benefit from their experiences.

To access the NCHRP Report 500 guides, go to http://safety.transportation.org. The Web page versions contain links to relevant programs, resources, and Web sites. "We wanted users of the guides to have ready access to the best available resources, including indepth information that would assist them in implementing a particular strategy," says Neuman.

California Highway Patrol Photography Unit

California was one of the first States to convene a special task force, shown here, to address traffic safety issues for older adults. The task force released its report, *Traffic Safety Among Older Adults: Recommendations for California*, in 2002.

NCHRP Report 500 guides are comprehensive in scope and target a broad audience of potential users, including State and local transportation officials, safety engineers, planners, law enforcement officials, motor vehicle administrators, and emergency medical services providers. The guides also are part of a broader package of resources available to the States, including an integrated safety management process, a self-assessment tool, and other related documents.

What Does the Older Driver Guide Recommend?

The older drivers guide (volume 9) includes 5 overarching objectives and 19 specific strategies. Volume 9 focuses on accommodating older drivers on the roadway as well as sustaining their driving proficiencies. The following sections offer highlights from the guidance and strategies.

Objective 1: Plan for an Aging Population. The tenet behind SHSP is that a comprehensive, integrated approach is needed to significantly reduce highway deaths and injuries, especially for improving the safety of older road users. Statistics clearly demonstrate the urgent need for action, which must go beyond the efforts of a single department, agency, or organization. The guide supports the principle that, "like the national plan, these State and local action plans need to reflect the input of a broad consortium of governmental agencies and organizations and interests in the private sector. Although State transportation departments can lead the effort, they need to create partnerships with other departments and agencies at the State, regional, and local levels." Potential collaborators include State offices on aging, area agencies on aging, transportation service providers, social service agencies, and various private sector organizations. Perhaps most important, seniors themselves need to be involved in the planning process.

The guide identifies several States and metropolitan planning organizations that already have addressed the challenge of planning for an aging driving population. These include California, Florida, Iowa, Maryland, Michigan, and Maricopa County in Arizona. The electronic version of the guide includes links to actual planning documents that the States have developed. Patti Yanochko, program coordinator at the Center for Injury Prevention Policy & Practice in San Diego, CA, helped direct efforts in California. She says, "All of our many task force members and consultants worked diligently and with passion to produce recommendations that are meaningful and improve safety and quality of life for older adults."

Objective 2: Improve the Roadway and Driving Environment. Many of the strategies recommended in the guide address specific roadway design and traffic operation changes that can improve safety for older drivers. The guide makes clear, however, that it is not just older drivers who will reap the benefits, but rather the changes could improve

Emphasis Areas in AASHTO's Strategic Highway Safety Plan

Emphasis Area	2003 Deaths	Comments
Young drivers	3,571	Ages 16–20
Suspended/revoked licenses	6,973	Involving a driver with invalid licensing
Older drivers	2,716	Ages 65–74
	3,914	Age 74+
Aggressive/speeding drivers	11,990	Speeding/driving too fast for conditions
	3,565	Reckless driving
Impaired drivers	17,013	Alcohol-impaired
Drowsy or distracted drivers	3,730	Inattentive
	1,577	Fell asleep
Safety belts	18,019	Drivers and occupants unbuckled
Pedestrians	4,749	
Bicyclists	622	
Vehicle and train crash	324	
Motorcyclists	3,661	
Heavy trucks	4,986	Deaths in vehicles
Safety enhancements in vehicles		Cannot accurately ascertain, although 14 unintentional deaths were associated with carbon monoxide alone in 2002
Run-off-the-road	18,781	Most harmful event involved fixed object or rollover
Intersections	6,903**	
Work zones	1,028	
Survivability of severe crashes	1,850**	Rural: Time from crash to hospital >1 hour
	258**	Urban: Time from crash to hospital >1 hour
TOTAL DEATHS	**42,643***	

***The total deaths are less than the sum of the numbers since some fatal crashes involve more than one key emphasis area.**
****Fatal crashes only, not individual fatalities.**
Source: AASHTO.

Peter Eng, TxDOT

Tyler, TX, has an exceptionally large and growing population of older adults. Advance street name signs, such as the one shown here, are only one of many roadway improvements Tyler officials have undertaken to improve safety for its older drivers.

safety for *all* drivers on the roadway. The 11 strategies under this objective draw heavily from FHWA's *Highway Design Handbook for Older Drivers and Pedestrians* (FHWA-RD-01-103), first published in 1998 and updated in 2001. In identifying strategies for inclusion in the guide, emphasis was placed on improvements that could be accomplished at relatively low cost and within a reasonable timeframe, effectively answering the question: What will give State and local transportation departments the greatest return on their safety investments?

The recommended strategies identify needs regarding signage, intersection design, traffic control and operations (especially in work zones), and roadway delineation. For example, States are encouraged to increase the size and letter height of roadway signs, and to provide protected left-turn signal phases at high-volume intersections. In many cases the point is made that the needed changes can be accomplished at relatively low cost if States begin now to incorporate them into new projects and scheduled maintenance and reconstruction. "The most important thing," says Tom Welch, Iowa's State transportation safety engineer and a contributor to the guide, "is that engineers realize that the 'design driver' for the 21st century is no longer a 45-year-old male. It's someone in the 65-plus age group, and it may just be their mom."

Objective 3: Identify High-Risk Older Drivers. Four strategies are recommended for identifying older drivers at increased risk of crashing and for intervening to lower that crash risk. State motor vehicle administrators are encouraged to review the role and functioning of their medical advisory boards (MABs), which help to ensure that drivers, regardless of their ages, are medically fit to drive. Currently, not all States have active MABs, and those that do have them reflect a variety of models. MABs can be expected to play an increasingly important role in the licensing process as the driving population ages.

With or without the help of an MAB, States are encouraged to review and update procedures for assessing medical fitness to drive, including training license examiners (department of motor vehicles personnel responsible for issuing drivers licenses) and working with State medical associations to educate the health community about the important role physicians can play in assessing and counseling older patients who drive. The Model Driver Screening and Evaluation Program recently carried out in Maryland

Florida Department of Highway Safety and Motor Vehicles

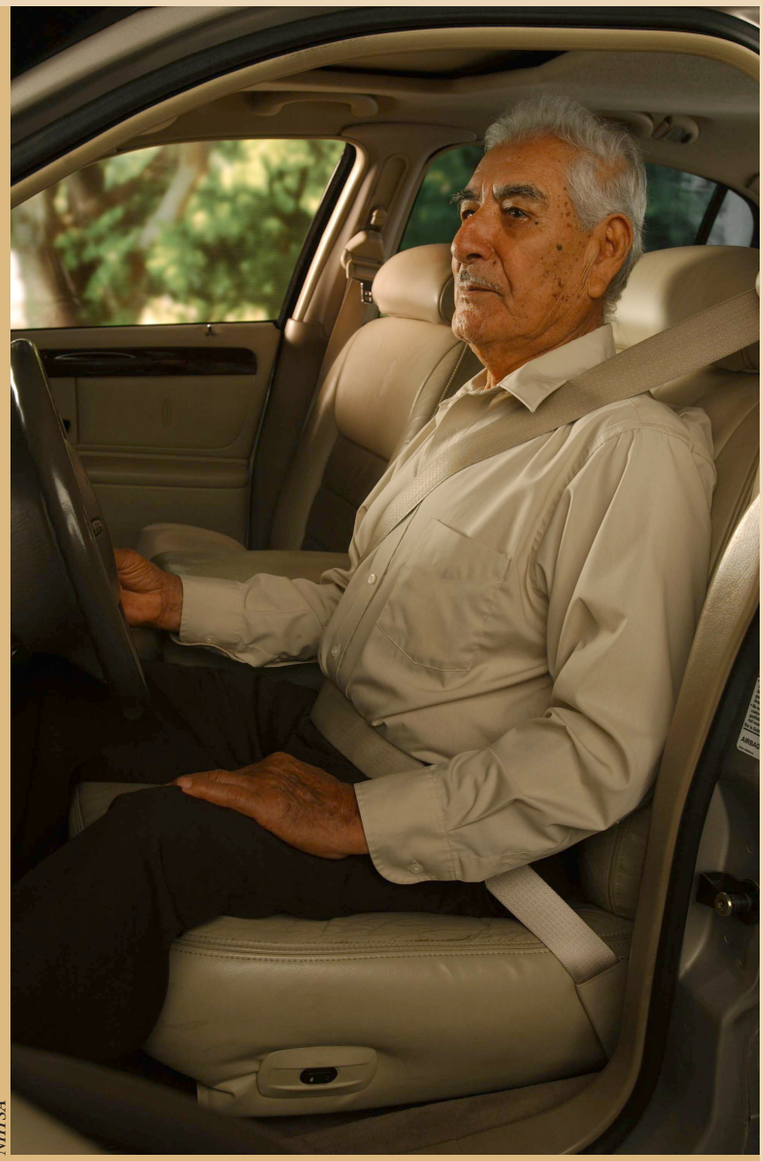
Through its GrandDriver and Elder Road User programs, Florida seeks to lead the way in responding to the needs of older motorists, like this man.

is cited in the guide as a source of information, along with examples.

A related strategy is to encourage physicians and other medical professionals, law enforcement, and family and friends to report potentially unsafe drivers. Again, the guide identifies model programs and materials, such as Oregon's Medically At-Risk Driver Program. In addition to training physicians in how to identify and report medically at-risk drivers, the Oregon DOT's Driver and Motor Vehicles Division (DMV) supports a volunteer reporting program for law enforcement and family or friends, and offers a Web site (www.oregonsafemobility.org) that helps educate the public through a campaign called "Shifting Gears in Later Years." Bill Merrill, manager of Oregon DMV's Driver Control Unit, helped to create the campaign. He says, "Safe mobility begins with awareness of one's own driving abilities and planning for the time when it may not be safe to drive anymore. When safety becomes an issue, family, friends, or a medical professional may need to intervene."

The final strategy in this section of the guide recommends that State DMVs join with the private sector to provide remedial assistance to drivers identified with functional impairments. Although some people can be helped to continue driving by appropriate restrictions on their licenses, others may require special adaptive equipment installed in their vehicles or evaluation and training by an occupational therapist or other specialist. Selma Sauls, a licensing specialist with the Florida Department of Highway Safety & Motor Vehicles, says that "knowing what options exist, and making the right referral, can make all the difference in individuals being able to continue to provide for their own safe mobility."

Objective 4: Improve Driving Competency of Older Adults. Here the guide shifts the focus from at-risk drivers to the general older driver population. After all, the majority of older drivers do not face serious medical conditions or functional limitations that affect their driving and would not come to the attention of licensing authorities. Still, drivers need to be educated about how aging can affect their driving and the steps they can take to compensate. Ultimately, those drivers may need help in relinquishing their licenses and shifting to alternative forms of transportation.



NHTSA

The final objective in TRB's older driver guide is to reduce injuries after a crash occurs, and the best way to do that is to buckle up, as this older driver has done.

The recommended strategies under this objective include establishing resource centers within communities to promote safe mobility choices and providing educational and training opportunities to older drivers. Ideally, seniors would have access to one-stop shopping for information and services. One example cited in the guide is the Older Driver Family Assistance Help Network in Erie County, NY. Under the network, nearly 50 agencies and organizations came together to provide assistance to families, friends, and caregivers concerned about aging loved ones who are driving at risk.

Educational opportunities for older drivers can range from simple brochures and other print materials to self-assessment tools; refresher classes; or one-on-one, behind-the-wheel evaluation and training. The guide contains electronic links to many of the materials or information on how to order them. State DMVs and drivers license offices can make resources available on

Promoting the AASHTO Plan

AASHTO, NCHRP, USDOT, and the Governors Highway Safety Association are providing extensive outreach efforts to help in implementing the plan. The four organizations are encouraging senior officials in State and local agencies to make highway safety a top priority and to focus on emerging older driver issues.

For example, at the 2005 Safety Leadership Forum II in Galloway, NJ, former Michigan Department of Transportation Director Gloria Jeff led a session of State DOT chief executive officers who explored ways of improving mobility and safety for senior citizens. Several recommendations emerged from the session:

- ***Education Programs:*** Educate older drivers on how to assess their own driving skills. Ensure that DOT traffic engineers who are designing safety solutions take into account the differences in the capabilities of older drivers, avoiding standard assumptions about driver capabilities.
- ***Standards Review:*** AASHTO, FHWA, and the National Committee on Uniform Traffic Control Devices should review all design and traffic control standards for possible modifications to address the increasing numbers of older drivers and the differences between older drivers and other drivers.
- ***Planning:*** Encourage States to develop safety action plans to address older driver issues.
- ***Land Use:*** When developing residential and commercial property, link the issue of older people's mobility with land use planning to reduce isolation caused by lack of access to transportation.
- ***Collaboration:*** Increase communication among State and Federal agencies to ensure that all are aware of tools and programs being developed to address older drivers and senior mobility.
- ***Technology:*** Ensure that in-vehicle technology is designed to be clearly visible and thus usable by older people. Develop technology links to the fourth "E," emergency services. [Refers to the classic four elements, or "E's"—engineering, enforcement, education, and emergency medical services.]

their Web sites and at local licensing offices, as well as to organizations serving older adults.

Objective 5: Reduce Risk of Injury and Death to Crash-Involved Older Drivers and Passengers. The last objective shifts focus from avoiding crashes to protecting older occupants of vehicles once a crash occurs. Older bodies are more fragile than younger bodies, and older car occupants are much more likely to die from a car crash. Seatbelts save lives for everyone but are especially beneficial to older drivers and passengers. A 2002 NHTSA study, covered in an article by E.K. Wagner and C. Gotschall in the *Transportation Research Record* (#1818), indicated that unbelted older people are five times more likely to be killed than belted older people and concluded that "potential improvements to occupant protection within the vehicle, although important, may have less to offer older people than the simple use of seatbelts."

Demonstrating the Guide's Usefulness

As shown in examples found throughout the guide, some States already are actively engaged in improving safety for older drivers. But many States still lack a comprehensive, coordinated approach for achieving progress in this area. The final section of each of the guides in TRB's NCHRP Report 500 outlines

Driver safety classes, such as AARP's recently updated Driver Safety Program, can help older adults learn about age-related changes that can affect their driving and about ways to remain safe behind the wheel. These women are reviewing course materials during one such class.

AARP

Mn/DOT

The Minnesota Department of Transportation (Mn/DOT) recently conducted side-by-side comparisons of its current sign sheeting material versus a new product on the market. Drive-by tests were conducted in June 2005 at a closed test track during both daylight and nighttime conditions. As illustrated by these two stop signs photographed at dusk, the researchers determined that the new product (left) proved brighter than Mn/DOT's existing sheeting (right). As a result, Mn/DOT began specifying the new sheeting material on all new sign placements.

an 11-step model for implementing the program of strategies presented.

Minnesota and Texas were invited to demonstrate the applicability of the older driver guide. Working over a period of approximately 6 months, the two States recruited team members, reviewed crash data, and used the guide to help identify and develop strategies for addressing a given priority.

The Minnesota team, led by State Traffic Safety Engineer Loren Hill, included representation from the Department of Public Safety's Driver and Vehicle Services team and Office of Traffic Safety. It also included a specialist in geriatric research from the Geriatric Research Education and Clinical Center at the Minneapolis Veterans Administration Medical Center. Team members shared information throughout the course of the project and plan to continue to serve as resources for one another. "We see this as a very positive outcome of the project," says Hill, "and one that will facilitate future efforts to form a broad-based coalition in the State for addressing older adult transportation safety and mobility issues."

In Texas, activity was focused at the local level, specifically the neighboring communities of Tyler and Atlanta, in the far eastern part of the State. In Tyler, planned roadway and signage improvements were supplemented by efforts to engage a broader sector of the community in addressing other problems facing older adults, such as accessing a senior center from a bus stop located across from a highway. According to Texas Department of Transportation (TxDOT) engineer Peter Eng, who led the program in Tyler, "Efforts such as these are complementary to our engineering efforts to improve the safety of older drivers in the county." In nearby Atlanta, TX, examination of local crash data revealed a high concentration of left-turn angle collisions at unsignalized intersections and run-off-road collisions involving drivers aged 65 and older along two highway corridors.

Drawing from the recommendations included in the guide, a number of countermeasure alternatives were identified. Carlos Ibarra, TxDOT's director of transportation operations for the Atlanta district, reports that "funding is already allocated for improvements to these roadways."

Next Steps

In the coming years, improving safety for older road users will be critical to helping the Nation achieve its goal of no more than 1 traffic fatality per 100 MVMT by 2008. Strategic highway safety plans, best practices, and *A Guide for Reducing Collisions Involving Older Drivers* will help State and local practitioners and advocates put the plan into action. Successfully meeting this national goal will require the efforts of organizations at the Federal, State, and local levels.

Jane Stutts, Ph.D., is associate director for social and behavioral research at the University of North Carolina (UNC) Highway Safety Research Center. During her 30-year career at the center, she has managed projects in a wide variety of highway safety areas and has written more than 100 articles and technical reports. She received her undergraduate degree in psychology from Wake Forest University and a Ph.D. in epidemiology from UNC-Chapel Hill.

Ingrid Potts, P.E., is a senior traffic engineer at the Midwest Research Institute (MRI), where she has spent nearly 10 years conducting research in highway safety, geometric design, and traffic operations. Before joining MRI, she worked as a highway design engineer at HNTB Corp. She received her undergraduate degree in physics from North Park College and a master's degree in civil engineering from Texas A&M University.

For more information, contact Jane Stutts at 919-962-8717, jane_stutts@unc.edu or Ingrid Potts at 816-360-5284, ipotts@mriresearch.org.

This article is the third in a series on older drivers and road users that is running in PUBLIC ROADS.

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

Gulf Coast States Receive $868 Million For Hurricane Reconstruction

In January 2006, U.S. Secretary of Transportation Norman Y. Mineta announced that Gulf Coast States still rebuilding after 2005's devastating hurricanes will share $868 million in Federal funds aimed at fueling road and bridge projects.

Florida, Louisiana, Mississippi, and Texas will use the money to repair or rebuild federally supported highways and bridges damaged by Hurricanes Katrina and Rita, Mineta said.

"This money gives States the confidence of knowing we are with them," Mineta said. Eligibility for Federal funds varies by project, but in most cases, the Federal Government will pay for 100 percent of the work, he added.

The funding was included in a $2.75 billion emergency relief package requested by President George W. Bush and approved by the U.S. Congress in late 2005.

Earlier, USDOT sent $25 million each to Louisiana and Mississippi, enabling them to begin repairs while they awaited Congressional action on a more comprehensive transportation funding package.

Technical News

Electronic Toll Collection Reduces Harmful Air Emissions

The Federal Highway Administration (FHWA) and the National Transportation Center at Morgan State University in Maryland recently completed a study that examined changes in mobile air emissions after electronic toll collection systems were installed at three major toll plazas outside Baltimore. The system used toll tag readers and in-vehicle transponders to execute toll transactions automatically as vehicles passed through toll booths. Based on field observations of traffic conditions at the Fort McHenry Tunnel, the Baltimore Harbor Tunnel, and the Francis Scott Key Bridge, researchers used computer models to simulate traffic patterns and quantify emissions of hydrocarbons, carbon monoxide, and nitrogen oxides before and after the systems were deployed.

The researchers simulated three scenarios to evaluate the impacts on air quality. The first represented conditions prior to the deployment (early spring of 1999). The second represented conditions as the market penetration rates reached 21–28 percent (summer of 1999), and the third represented conditions as market penetration rates reached approximately 50 percent (2001).

A comparative analysis of the pre- and postdeployment scenarios showed that the electronic toll collection system reduced hydrocarbons and carbon monoxide emissions by 40–63 percent and reduced emissions of nitrogen oxides by approximately 16 percent.

For more information, visit www.itsbenefits.its.dot.gov/its/benecost.nsf/0/A54E49709FE232D852570A7004590D8?OpenDocument.

FHWA Develops Guidelines for Road Tunnel Design

During the past 10 years, highway agencies built major road tunnel projects in Alaska, Arkansas, Massachusetts, and other States. These tunnels were built using generally accepted procedures influenced by bridge standards and specifications developed by the American Association of State Highway and Transportation Officials and other organizations. Until recently, however, uniform national standards or guidelines had not existed.

AAA Foundation for Traffic Safety

The *FHWA Road Tunnel Design Guidelines* provide design standards for tunnels like the one shown here on Skyline Drive near U.S. 211 in the Shenandoah Valley, VA.

"Many designers have expressed a need for design standards," says Jesus Rohena, senior tunnel engineer at FHWA. "There was a gap that needed to be filled. Also, because there has been little uniformity of approach to tunnel designs in the past, there are now widely varying designs. And in some cases, projects are overdesigned."

To help fill the void, FHWA recently developed the *FHWA Road Tunnel Design Guidelines* (Publication No. FHWA-IF-05-023), which provide technical design criteria on topics such as planning, design, machinery, and construction.

The next phase of the initiative is to expand the guidelines and develop a *Road Tunnel Design Manual.* "The manual will be more detailed, covering procedures and all the steps that need to be followed to design a tunnel," Rohena says. The manual, expected to be

completed in 2007, will incorporate the latest accepted national and international technologies and methods for the design and construction of long-lasting tunnels.

To obtain a copy of the FHWA Road Tunnel Design Guidelines, *contact the National Technical Information Service (NTIS) at 800-553-6847 or info@ntis.gov, or visit its Web site at www.ntis.gov. The NTIS document number for the publication is PB2006-100660. For more information, contact Jesus Rohena at 202-366-4593 or jesus.rohena@fhwa.dot.gov.*

Public Information and Information Exchange

FHWA Honors 2005 Roadway Safety Initiatives

FHWA and the Roadway Safety Foundation (RSF) recently honored the winners of the "2005 National Roadway Safety Awards." Out of the 65 life-saving projects submitted, 14 winners received the award for their innovation and excellence in operations, planning, and roadway design to reduce fatalities. The winners included State DOTs, State police agencies, metropolitan planning organizations, and the U.S. Department of Agriculture Forest Service.

FDOT

Red-light running violations were reduced by 50 percent at an intersection in Clearwater, FL, after traffic managers installed intersection enforcement lights like the one shown here. The white light illuminates with a specific red light so that when a violation occurs, a single police officer positioned downstream can both observe the violation and pull over the offender.

The winning projects represented the key components of safety: engineering, education, and enforcement. FHWA Acting Administrator J. Richard Capka, FHWA Acting Associate Administrator for Safety Michael Halladay, and RSF Executive Director Gregory Cohen presented the awards.

A complete brochure of the awards is available at http://safety.fhwa.dot.gov/awards.htm. The next National Roadway Safety Awards competition will take place in 2007. For more information, please contact Kathy Krause at 202-366-9265 or kathy.krause @fhwa.dot.gov.

TDOT Debuts Web-Based Map Showing Road Conditions

The Tennessee Department of Transportation (TDOT) recently debuted an electronic map displaying road conditions, as part of its SmartWay information system on the department's Web site.

"This is an exciting advancement in the level of information we can provide to the public," says TDOT Commissioner Gerald Nicely. "It is a much more sophisticated map that can provide specific road condition information like we were never able to do before, plus it is now easier and faster to use."

This is the first major improvement to the map since the late 1990s. In its early form, the map provided road conditions only on a county-by-county basis.

"This advanced SmartWay system allows people to log on and pinpoint specific roadways rather than just a county to find out the current driving conditions," adds Judy Steele, director of TDOT's Community Relations Division. "We sincerely hope that people will use the map frequently and begin to depend on it as an important travel tool when planning their driving trips any time of the year."

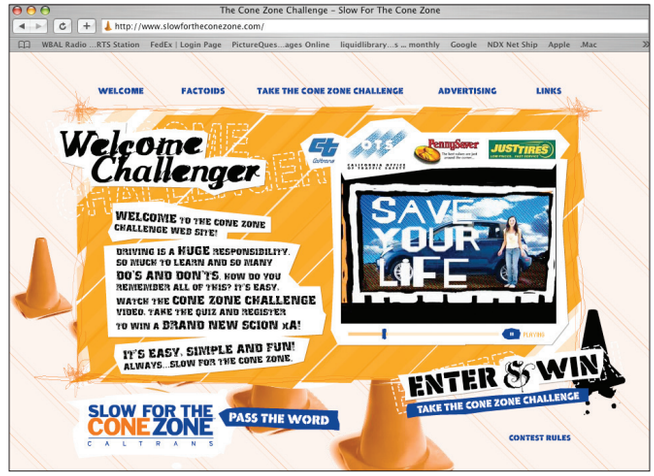
Weather-related road conditions displayed on the map include snow, ice, and flooding. Users can view information on a statewide, regional, or local scale. Options include information about construction, roadway incidents, traffic flow, and road conditions. The map also will enable users to view TDOT SmartWay cameras and variable message signs in Knoxville, Memphis, and Nashville.

To access the map, visit www.tennessee.gov/tdot.

TDOT

Caltrans Wants Teens to "Slow for the Cone Zone"

The California Department of Transportation (Caltrans) is launching a statewide driver safety education campaign urging teens to "Slow for the Cone Zone" and drive safely through work zones. As an incentive, Caltrans is offering participating high school students a chance to win a new car, tires, rims, and car insurance for a year.



"Slow for the Cone Zone" uses classroom materials and private driver training to teach teens to be watchful and slow down in highway construction and work zones. At a news conference at C.K. McClatchy High School in Sacramento, CA, Caltrans Director Will Kempton explained the details of the campaign and sweepstakes, which is sponsored in part by the California Office of Traffic Safety.

"Driving is a huge responsibility, and 16-year-olds are four times as likely as other drivers to be killed in a collision," Kempton said. "Caltrans wants to reinforce safe driving habits, especially in work zones. We hope this incentive will help get teens' attention."

To qualify, teen drivers must watch a short educational DVD, answer 13 questions on the "Slow for the Cone Zone" Web site (www.slowfortheconezone.com), and fill out an entry card. Those who answer correctly will be entered to win a new car with upgraded tires and rims, plus a year of car insurance.

"Slow for the Cone Zone" is a public awareness campaign that aims to save the lives of highway workers, drivers, and passengers in work zones. Since it was launched in 1999, the campaign has reduced deaths and injuries to motorists in highway work zones.

For more information, visit www.dot.ca.gov or www.slowfortheconezone.com.

Caltrans

License Plates to Benefit Children Of Fallen Highway Workers

The American Road & Transportation Builders Association (ARTBA), along with Associated Pennsylvania Constructors (APC), is launching a public awareness campaign to help improve safety in roadway work zones and directly benefit the children of highway workers killed on the job.

The goal of the front license plates (shown here) is to increase public awareness of the need to drive responsibly in highway work zones and to raise scholarship money for the children of fallen highway workers. *Photo: Associated Pennsylvania Constructors.*

APC developed license plates with the message "Slow Down! Highway Workers" and asked its members to outfit their construction fleets with them. The plates were designed at the direction of the APC/Pennsylvania Department of Transportation Joint Safety Committee to educate motorists about the need to drive responsibly in highway work zones.

Proceeds from the sale of the plates will be used to support the ARTBA Transportation Development Foundation's (ARTBA-TDF) Highway Worker Memorial Scholarship Program, which provides post-high school financial assistance to the children of highway workers killed or permanently disabled on the job. Over the past 5 years, the foundation has awarded nearly 50 scholarships.

ARTBA

HIPERPAV Paves the Way With Honors

To open newly constructed pavements within days or hours after the work is completed, pavement contractors in the early 1990s used "fast-track" concrete mixes that gain strength rapidly but can be severely damaged if placed during adverse weather conditions. In response to this problem, Stephen Forster, former technical director for Pavement Research & Development at the Turner-Fairbank Highway Research Center, led a research effort involving FHWA, The Transtec Group, Inc., academia, State DOTs, industry, pavement contractors, and materials suppliers to create the HIgh PERformance PAVing (HIPERPAV™) software program. HIPERPAV provides guidance on designing and constructing concrete pavements.

Recently the American Concrete Pavement Association (ACPA) selected HIPERPAV as the winner of its 2005 Marlin J. Knutson Award for Technical Achievement. The annual award goes to a project that has made significant contributions to advance the development and implementation of innovative technical and best practice approaches in the design and construction of concrete pavements.

Released in 1996, HIPERPAV operates in a Microsoft® Windows® environment and helps pavement planners and designers predict stresses and strength in early-age concrete. It also helps users evaluate the potential for uncontrolled cracking in new concrete pavements during construction. The program makes these predictions by considering the potential impact of various construction procedures, mix and pavement designs, traffic levels, and environmental factors on the overall long-term performance of the pavement.

In 2005, FHWA released HIPERPAV II, an expanded version of the software containing new features and modules. The first module enables users to see the effect that early-age design and construction strategies can have on the long-term performance of jointed plain concrete pavement. The second module predicts the behavior of continuously reinforced concrete pavements for the days and months after placement. Other improvements in HIPERPAV II include enhanced materials characterization, additional flexibility in climatic input, and a completely redesigned graphical user interface.

For more information on HIPERPAV, visit www.fhwa.dot.gov/pavement/pccp/hipemain.cfm or contact Fred Faridazar at 202-493-3076, fred.faridazar@fhwa.dot.gov or Mauricio Ruiz at 512-451-6233, mauricio@thetranstecgroup.com.

Reporting Changes Of Address

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Training Update

NATIONAL HIGHWAY INSTITUTE

Environmental Justice Course Responds to Agency Needs

When an interstate that cuts through an older section of a city needs reconstruction, how does a transportation agency respond to potential impacts on adjacent low-income communities? When a large number of immigrants move into an area, how should transportation officials identify the new residents' transportation needs? These are typical questions raised by participants in the National Highway Institute's (NHI) course, Fundamentals of Title VI/Environmental Justice (FHWA-NHI-142042).

As part of the South Park Avenue Improvement Project in Tucson, AZ, public art elements include historic plaques like this one that recognize community pride. *Photo: Tucson Pima Arts Council.*

The U.S. Department of Transportation (USDOT) and its partners are committed to nondiscrimination in all Federal-aid programs. There are many opportunities to avoid, minimize, and mitigate the adverse and disproportional impacts transportation can have on minority or low-income populations. Beyond avoiding negative impacts, transportation professionals need to understand the transportation needs of different groups and engage minority and low-income communities in the decisionmaking process. This NHI course presents a framework for using a variety of approaches and tools to accomplish environmental justice goals.

Since 2001, NHI has delivered the course more than 20 times in States from California to New Jersey and from Michigan to Texas. In 2005, NHI updated the course to include more recent examples that reflect advances in practice at the State, regional, and local levels.

The course includes 2 days of instruction for 25 to 30 participants. Instructors describe how environmental justice and Title VI of the Civil Rights Act of 1964 apply to every stage of transportation programs. After providing a background in civil rights issues, the course takes participants through the stages from planning to environmental review and covers right-of-way acquisition and relocation, construction, and operations. Group exercises and discussions are interspersed throughout each learning module to keep participants engaged.

By the end of the course, participants will have the basic information they need to apply environmental justice to their everyday work. Specifically, participants will be able to do the following:

- Define environmental justice and describe its relationship to Title VI of the Civil Rights Act of 1964
- Explain the fundamental principles of environmental justice
- Apply the principles of environmental justice to transportation decisions
- Identify how environmental justice applies to every stage of transportation decisionmaking
- Describe the benefits of environmental justice in transportation decisionmaking
- Develop proactive strategies, methods, and techniques to apply to programs and projects

The course is designed for Federal, State, and local transportation agency personnel who interact with minority and low-income communities. Participants typically include highway and metropolitan transportation planners, public transportation planners, environmental specialists, public involvement specialists, system operators, rural and small community planners, and consultants.

One of the exciting aspects of the course is the mix of people who attend, says Carlos Gonzalez, a course instructor from the FHWA Georgia Division Office. "The course provides a forum for the exchange of ideas," he adds. Because a variety of people attend the course, there are excellent opportunities for participants to learn from each other's experiences.

These professional staff members at the West Florida Regional Planning Council—the designated metropolitan planning organization for the Pensacola, FL, area—provide workshops and training to inform, educate, and involve the public and reach out to underserved populations. *Photo: Nancy Model, West Florida Regional Planning Council.*

"As an instructor, I am able to learn about innovative practices and ways that different State departments of transportation are addressing the social and cultural impacts of transportation projects," Gonzalez says. "Traveling to various States as an instructor, I see the diversity of our country and the wealth of knowledge present in each and every person. I try to be mindful of this as I work as a transportation planner. We are all different, but at the core, we all have something valuable to contribute."

For more information, contact David Kuehn at 202-366-6072 or david.kuehn@fhwa.dot.gov. To schedule a course, contact the NHI Training Coordinator at 703-235-0528 or nhitraining@fhwa.dot.gov. To obtain information about NHI courses, access the course catalog at www.nhi.fhwa.dot.gov or contact NHI at 4600 N. Fairfax Drive, Suite 800, Arlington, VA 22203; 703-235-0500 (phone); or 703-235-0593 (fax).

Internet Watch

By Denise Rigney

Green Highways: Merging Transportation And Environmental Missions

For years, two disparate communities dedicated to improving the lives of the American people struggled to achieve a common understanding. With a mission to protect human health and the natural environment, the environmental community has focused on safeguarding life's necessities including potable water and clean air. The transportation community, on the other hand, maintains a focus on building safe, sustainable highways and livable communities, while addressing the challenges that result from increasing growth and congestion. Historically, the dedicated public servants within the environmental and transportation communities sometimes viewed each other's missions as mutually exclusive or as roadblocks to achieving their respective goals. The Mid-Atlantic Green Highways Initiative, recently renamed the Green Highways Partnership (GHP), aims to bridge the gap between environmental and transportation issues.

Sponsored by the U.S. Environmental Protection Agency's (EPA) Region III and the Federal Highway Administration (FHWA), the GHP is a network of industry, trade, and environmental organizations; private sector consultants and contractors; and local, State, and Federal Government partners. The goal is to develop mechanisms and actions for meeting transportation requirements and improving the natural, built, and social environment—striving for conditions that are "better than before."

Web Site Drives Collaboration

To facilitate merging transportation and environmental missions and developing successful streamlining and stewardship practices, GHP created a Web site, www.greenhighways.org, to serve as the hub for information and technology transfer. The target audience for the "Green Highways Initiative" Web site includes researchers, practitioners, contractors, policymakers, regulators in transportation and environmental agencies, and members of nongovernmental organizations and industry trade organizations.

The site will feature research agendas, regulations, policies, practices, tools, and products in GHP's three theme areas: watershed-driven stormwater management, recycling and reuse of industrial byproducts and other materials, and conservation and ecosystem management. The highest priorities for the GHP Web site are communication, information sharing, and collaboration. The first thing visitors see on the homepage is up-to-date information on GHP activities, which include a forum, an ad hoc committee, an executive committee, and theme teams.

Practice Makes Perfect

GHP highly values the use of pilot projects to assist in identifying and implementing practices that are cost effective, provide environmental benefits, and have market appeal. The Web site will serve as a clearinghouse for exchanging research results and lessons learned from pilot projects that are applicable to the three theme areas.

The pilot projects will generate data on costs, the effectiveness of tested solutions, and construction issues that are relevant to the industry. These data will help establish baseline protocols and metrics. Users can check the Web site for progress on projects such as the proposed pilot on watershed-driven stormwater management, which will be spearheaded by the Maryland State Highway Administration, EPA, the Low Impact Development Center, and the Global Environment and Technology Foundation (GETF). GETF—under the direction of the GHP Web site advisory board and with support from public and private investors—will develop, house, and maintain the Web site.

Initially, the stormwater management pilot will produce a set of values—such as linear feet of restoration, acreage of restored wetlands, or reductions in mass of pollutants—that researchers can use in trading schemes for wetlands creation and stream restoration. Further, the pilot will produce a number of innovative context-sensitive structural and nonstructural practices that the design community could apply to other transportation projects.

For more information, contact Noeleen Tillman, GETF vice president and GHP project manager, at 760-944-9398, or Marlys Osterhues, environmental protection specialist with FHWA's Office of Project Development and Environmental Review, at 202-366-2052.

Denise Rigney is the transportation liaison from EPA Region III's Water Protection Division, Office of State and Watershed Partnerships.

The "Green Highways Initiative" homepage.

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 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:

R&T Product Distribution Center, HRTS-03
Federal Highway Administration
9701 Philadelphia Court, Unit Q
Lanham, MD 20706
Telephone: 301–577–0818
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, FHWA's Web site at 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.

TechBrief: The Concrete Pavement Road Map Publication No. FHWA-HRT-05-074

The Concrete Pavement (CP) Road Map is a plan for concrete pavement research that will guide the investment of research dollars for the next several years. This TechBrief is a summary of the following two documents: *Long-Term Plan for Concrete Pavement Research and Technology—The Concrete Pavement Road Map: Volume I, Background and Summary* (FHWA-HRT-05-052) and *Long-Term Plan for Concrete Pavement Research and Technology—The Concrete Pavement Road Map: Volume II, Tracks* (FHWA-HRT-05-053).

For most of the 20th century, the same materials—portland cement, high-quality aggregate, and water—were used in pavement concrete, with only minor refinements. This fairly forgiving formula allowed variations in subgrade quality, construction practices, and other variables without sacrificing pavement performance.

In today's environment, however—with new, sometimes incompatible materials, more demanding production schedules, and other pressures—the old system for constructing concrete pavements is not as malleable. The CP Road Map gives the highway community an opportunity to reinvent itself proactively through research. By 2015, the highway community will have a comprehensive, integrated, fully functional system of CP technologies that provides innovative solutions for customer-driven performance requirements.

The document is available online at www.fhwa.dot.gov/pavement/pccp/pubs/05074. Free printed copies are available from the R&T Product Distribution Center.

Long-Term Plan for Concrete Pavement Research And Technology—The Concrete Pavement Road Map: Volume I, Background and Summary Publication No. FHWA-HRT-05-052

The concrete paving industry has experienced many changes in the last 15 years. To achieve concrete pavement's full potential in the 21st century, the industry identified trends that call for dramatic, even revolutionary, improvements. With an aim toward a holistic approach, the improvements can best be served by a carefully developed and aggressively implemented strategic plan for research and technology transfer. The *Long-Term Plan for Concrete Pavement Research and Technology* (CP Road Map) is that plan.

This is the first of two volumes. It provides the background and summary information on the effort that led to the development of the CP Road Map. Volume II contains the research problem statements to be addressed under the CP Road Map. Free printed copies are available from the R&T Product Distribution Center. The document also is available from NTIS. The NTIS order number is PB2006-100554.

Long-Term Plan for Concrete Pavement Research And Technology—The Concrete Pavement Road Map: Volume II, Tracks Publication No. FHWA-HRT-05-053

The *Long-Term Plan for Concrete Pavement Research and Technology* (CP Road Map) is a holistic strategic plan for concrete pavement research and technology transfer. The CP Road Map is a 7- to 10-year plan that includes 12 distinct but integrated research tracks leading to specific products and processes. The resulting improvements will help the CP industry meet the challenges of the 21st century and achieve the industry's

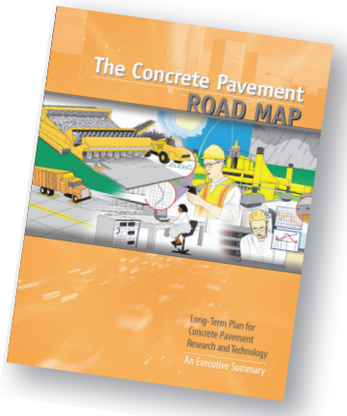
full potential. The plan was developed in close partnership with stakeholders representing all aspects of the CP community, public and private, and the research will be conducted through partnerships with stakeholders. The CP Road Map is presented in two volumes.

Volume I (FHWA-HRT-05-052) describes why the research plan is needed, how it was developed, and, generally, what the plan includes. Volume I also describes the research management plan that will guide the conduct and implementation of research.

Volume II describes in detail the 12 tracks of research. Each track description includes a general overview, a track goal, action items, a list of subtasks, and detailed problem statements within each subtrack. Free printed copies are available from the R&T Product Distribution Center. The document also is available from NTIS. The NTIS order number is PB2006-100555.

The Concrete Pavement Road Map—Long-Term Plan for Concrete Pavement Research And Technology: An Executive Summary Publication No. FHWA-HRT-05-047

The CP Road Map is a comprehensive and strategic plan for CP research that will guide the investment of research dollars for the next several years. It will result in technologies and systems that help the CP community meet the paving needs of today and the challenges of tomorrow. In short, the CP Road Map will result in a new generation of CP for the 21st century. The executive summary should be of interest to professionals involved with pavements.



The document is available online at www.fhwa.dot.gov/pavement/pccp/pubs/05047. Free printed copies are available from the R&T Product Distribution Center.

Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations: Final Report and Recommended Guidelines Publication No. FHWA-HRT-04-100

Pedestrians are legitimate users of the transportation system, and they should, therefore, be able to use the system safely. Engineers and designers need to identify and develop appropriate solutions to improve pedestrian safety and access. Deciding where to mark crosswalks is only one consideration in meeting that objective. The purpose of this study was to determine whether marked crosswalks at uncontrolled locations are safer than unmarked crosswalks under various traffic and roadway conditions. Another objective was to provide recommendations on safer crossings for pedestrians.

The study involved an analysis of 5 years of pedestrian crashes at 1,000 marked crosswalks and 1,000 unmarked comparison sites. All sites had no traffic signal or stop sign on the approaches. Researchers collected detailed data on traffic volume, pedestrian exposure, number of lanes, median type, speed limit, and other site variables. Then they used Poisson and negative binomial regressive models to analyze the data.

The study results revealed that on two-lane roads, the presence of a marked crosswalk alone at an uncontrolled location was associated with no difference in pedestrian crash rate compared to an unmarked crosswalk. Further, on multilane roads with traffic volumes above about 12,000 vehicles per day, having a marked crosswalk alone (without other substantial improvements) was associated with a higher pedestrian crash rate (after controlling for other site factors) compared to an unmarked crosswalk. Raised medians provided significantly lower pedestrian crash rates on multilane roads, compared to roads with no raised median. Older pedestrians had crash rates that were high relative to their crossing exposure.

The researchers recommended more substantial improvements to provide safer pedestrian crossings on certain roads, such as adding traffic signals with pedestrian signals when warranted, providing raised medians, and implementing speed-reducing measures.

The document is available from NTIS. The NTIS order number is PB2006-100611. Free printed copies also are available from the R&T Product Distribution Center. FHWA published an executive summary as FHWA-RD-01-075, which is available online at http://safety.fhwa.dot.gov/ped_bike/docs/cros.pdf.

Simplified Guide to the Incident Command System For Transportation Professionals Publication No. FHWA-HOP-06-004

With management of the Nation's highways now a 24-hours-a-day, 7-days-a-week enterprise, transportation professionals are more likely than ever to become involved in incident response and recovery. Those functions are thought of most often in terms of vehicle crashes, but State and local government agencies also are being called in to assist with natural disasters and to be prepared for potential terrorist attacks. Responses to such events often are managed through the Incident Command System (ICS) approach. Because many transportation professionals may be unfamiliar with the ICS approach, FHWA recently published the *Simplified Guide to the Incident Command System for Transportation Professionals.*

The document is available online at http://ops.fhwa.dot.gov/publications/ics_guide/index.htm.

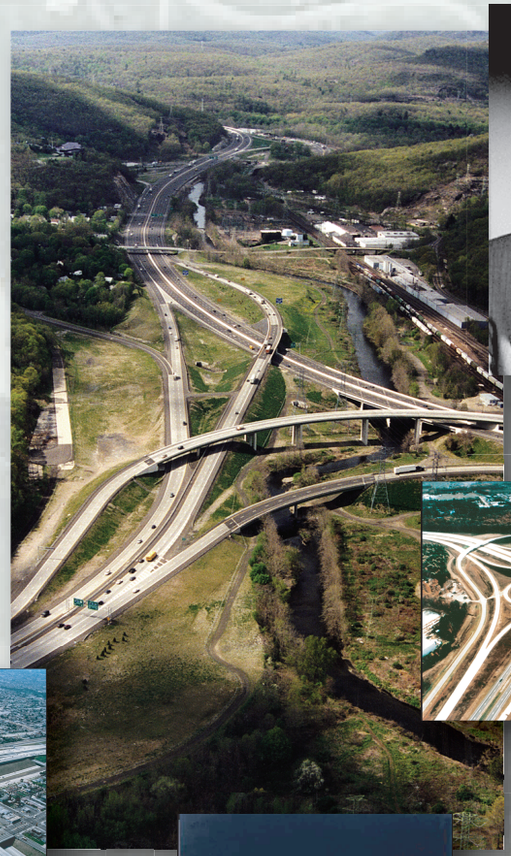
Conferences/Special Events Calendar

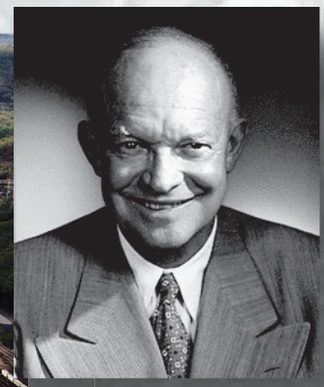
Date	Conference	Sponsor	Location	Contact
July 16–19, 2006	3rd International Conference on Bridge Maintenance, Safety, and Management (IABMAS 2006)	International Association for Bridge Maintenance and Safety (IABMAS)	Porto, Portugal	Sandra Pereira (+351) 253-51-0489 secretariat@iabmas06.com www.iabmas06.com
July 23–26, 2006	45th Annual Workshop on Transportation Law	Transportation Research Board (TRB)	Chicago, IL	James McDaniel 202-334-3209 jmcdaniel@nas.edu www.trb.org/Conferences/Law
July 25–29, 2006	5th International Symposium on Highway Capacity	TRB Committee on Highway Capacity and Quality of Service, Nagoya University, University of Tokyo, Tottori University, Toyo University, Yokohama National University, Tokyo Metropolitan University, and Kyoto University	Yokohama, Japan	Richard Cunard 202-334-2965 rcunard@nas.edu www.itr.genv.nagoya-u.ac.jp
July 30–August 2, 2006	2006 Pipelines Conference	American Society of Civil Engineers (ASCE)	Chicago, IL	Leonore Jordan 703-295-6110 ljordan@asce.org www.asce.org/conferences/pipelines2006
July 30–August 3, 2006	Second International Symposium on Transportation Technology Transfer	Federal Highway Administration (FHWA)	St. Petersburg, FL	Gib Peaslee 703-295-0532 gib.peaslee@fhwa.dot.gov Roger Dean 703-235-0550 roger.dean@fhwa.dot.gov Lori Byrd 850-942-9650, ext. 3018 lori.byrd@fhwa.dot.gov www.t2symposium.org
August 6–9, 2006	First International Conference on Fatigue and Fracture in the Infrastructure–Bridges and Structures of the 21st Century	Pennsylvania Infrastructure Technology Alliance, FHWA, TRB, The Port Authority of New York & New Jersey, and New Jersey Department of Transportation	Philadelphia, PA	Alyssa Clapp 610-758-3535 alcb@lehigh.edu http://ffconf.atlss.lehigh.edu
August 6–9, 2006	ITE 2006 Annual Meeting & Exhibit	Institute of Transportation Engineers (ITE)	Milwaukee, WI	Lisa Petty 202-289-0222, ext. 136 lpetty@ite.org Christina Denekas 202-289-0222, ext. 128 cdenekas@ite.org www.ite.org
August 13–16, 2006	Applications of Advanced Technology in Transportation	Transportation and Development Institute's Committees on Advanced Technology and Infrastructure Systems and University of Illinois, Chicago	Chicago, IL	Kelvin Wang 479-575-8425 kcw@engr.uark.edu www.asce.org/conferences/AATT2006
August 13–16, 2006	7th National Access Management Conference	TRB Committee for Access Management, Utah Department of Transportation, FHWA, TRB Committees on Geometric Design and Operational Effects of Geometrics	Park City, UT	Tim Boschert 801-965-4175 tboschert@utah.gov www.accessmanagement.gov/conference.html

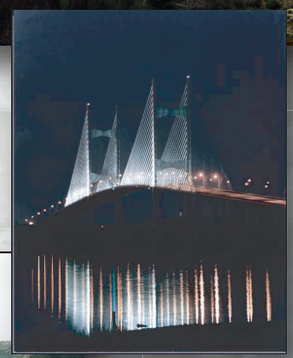
Happy 50th Anniversary
Eisenhower Interstate System

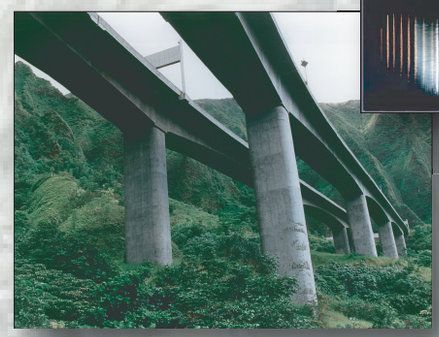
June 29, 1956–June 29, 2006

Fifty years after President Dwight D. Eisenhower signed the Federal-Aid Highway Act, the United States enjoys the benefits of his bold and visionary plan for connecting all Americans: Freedom, Mobility, and Prosperity.









. . . No challenge is too great for the United States when the appropriate leadership, focus, and unity of purpose exists.

—Norman Y. Mineta, Secretary of Transportation

U.S.Department of Transportation

Federal Highway Administration

Celebrating 50 Years

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Eisenhower Interstate System

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