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29

COVER: Workers tie reinforcing steel for the Shields Avenue bridge over the new I-40 alignment in Oklahoma City. (Photo courtesy of Oklahoma DOT)

TR NEWS

features articles on innovative and timely research and development activities in all modes of transportation. Brief news items of interest to the transportation community are also included, along with profiles of transportation professionals, meeting announcements, summaries of new publications, and news of Transportation Research Board activities.

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COMING NEXT ISSUE

As traditional sources of transportation funding falter, public–private partnerships are gaining attention as possible solutions. Feature articles slated for the May–June 2011 issue of *TR News* examine whether the model can meet the challenges; the selection of arrangements for projects; how to ensure value from the arrangements; ways to protect the public interest in long-term concessions; the appropriateness to U.S. contexts; how the model has worked in Europe; and more.

PHOTO: TOM SAUNDERS, VIRGINIA DOT

The Pocahontas Parkway, which links Chesterfield and Henrico counties in Virginia, crosses over I-95 and the James River. The state leased the road to a private entity, Transurban, in 2006.

The Young Impaired Driver Problem

Prospects for a Safer Future

KATHRYN STEWART

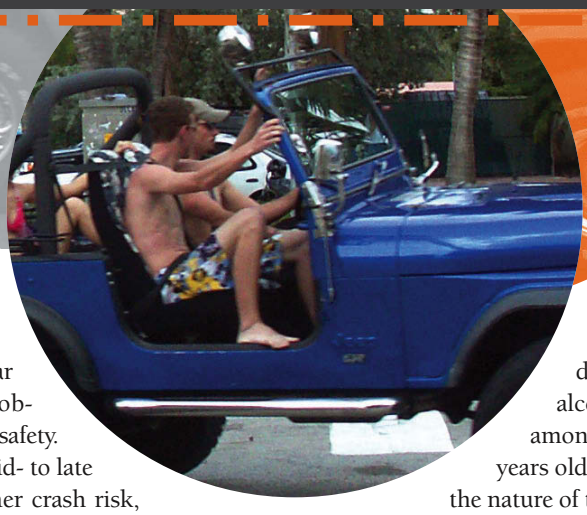

PHOTO: AAAFTS

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Young drivers pose particular risks and problems in traffic safety. Until they reach their mid- to late 20s, drivers have a higher crash risk, especially when crashes are adjusted for the amount of driving. Impairment by alcohol and drugs exacerbates these risks. Lack of driving experience, coupled with immature judgment, makes impairment by alcohol and drugs particularly dangerous.

Research has provided more information about the nature of the young impaired driving problem and the strategies that can improve traffic safety. In a two-day symposium in June 2008, the Transportation Research Board's Alcohol, Other Drugs, and Transportation Committee brought together experts from around the world to discuss issues related to alcohol and drug impairment among young drivers, 16 to 24 years old. The workshop examined the nature of the impaired driving problem among young drivers, as well as a range of strategies to reduce the problem. Following is a summary and update of the research presented at the workshop.

The U.S. Problem

Compared with older drivers, teenagers drink and drive less often, but when they drive after drinking, they are at considerably greater risk of involvement in a crash. Drugs also play a role in crashes among young drivers.

PHOTO: NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

Drivers under age 21 with blood-alcohol content (BAC) of .07 are more than five times more likely to crash than drivers over 21 with the same BAC.

PHOTO: WIKIMEDIA COMMONS

Teenagers are 20 times more likely to be involved in vehicle crashes that feature alcohol, speeding, and other passengers than are middle-aged adults; nighttime crashes involving alcohol and passengers are approximately nine times more likely for teens.

Until they reach their mid- to late 20s, drivers have a higher crash risk, especially when crashes are adjusted for exposure (*1*). After the drinking age was changed to 21 in the United States in the 1980s, alcohol-related crashes declined dramatically among drivers under 21.

Currently, when adjusted for exposure, 21- to 29-year-old drivers in the United States are at highest risk for drinking driver fatalities (*2*). When younger drivers drink, the risk of crashing is much higher than for older drivers. Among drivers with a blood alcohol concentration (BAC) of .07—the U.S. legal limit is .08—those under 21 are more than five times more likely to be involved in a crash than those over 21 (*3*).

When the risk associated with impaired driving is adjusted for exposure, drivers ages 16 to 20 have the highest risk of crashing per vehicle miles traveled, followed by drivers 21 to 29. Young male drivers are at dramatically greater risk than young female drivers. The differentials between the sexes persist through all ages but become less marked as drivers get older.

Research on the characteristics of risky young drivers and the crashes in which they are likely to be involved yield insights into ways to make these drivers safer.

Predictors of Impaired Driving

Personal and social factors among adolescents and young adults can predict impaired driving and risky driving (*4*); these can be categorized as follows:

- **The perceived environment:** more social support for drinking and drink driving, less parental monitoring, more parental permissiveness, and less perceived risk of drink driving, along with less parental nurturing during adolescence;
- **Personality:** more tolerance of deviance, less orientation to parents, more susceptibility to peer pressure, more risk-taking, more hostility, more aggression, and poorer grades in school, as well as less family connectedness; and
- **Behavior:** early and heavier drinking, cigarette and marijuana use, and more use of other drugs.

The perceived environment factors and the personality factors also predicted risky driving outcomes.

Characteristics of Crashes

The characteristics of crashes involving young drivers differ from those involving older drivers in some important ways. For example, underage drinkers typically consume larger amounts of alcohol in a single sitting compared with older drinkers (*5*). Therefore, when they drink and drive, they are likely to have a higher BAC than adults.

Other variables related to driving, alcohol use, or

PHOTO: AAA FOUNDATION FOR TRAFFIC SAFETY (AAAFTS)

The crash risks of teen drivers differ from those of adults in many ways; for example, the effect of passengers in the car. A teen driver's crash risk increases with each teen passenger; for adults, the presence of passengers has far less of an effect on crash risk.

the characteristics of crashes combine to have a greater effect on teenage drink drivers than on adult drink drivers. For example, adult drivers experience either no change in risk or a small safety benefit from having passengers; teenage drivers, however, have a greatly increased crash risk with teenage passengers, and the risk increases significantly with each additional passenger. As a result, crashes that involve alcohol, speeding, and passengers are about 20 times more likely for teenagers than for middle-aged adults. Crashes at night that involve alcohol and passengers are approximately nine times more likely (3).

The Problem in Europe

A more global perspective on the young driver problem offers additional insights. In Europe, the drinking age is lower than in the United States—18 in most countries, or even younger for some beverages and in some circumstances. In addition, enforcement of the drinking age traditionally has received little emphasis. The legal age of driver licensure, typically 18, tends to be higher than in the United States (*6*).

The belief that introducing drinking at an earlier age reduces heavy and harmful drinking is erroneous. The percentage of 15- to 16-year-olds who report drinking in the past 30 days is greater in nearly all European countries than in the United States. In addition, intoxication rates are higher among young people in most European countries than among youth in the United States. In a majority of European countries, a greater percentage of young people reports having been intoxicated before the age of 13 (*7*). If and how these drinking patterns change when European young people begin to drive is not known, but European statistics show an overrepresentation of young drivers in crashes (*8*).

According to some reports, binge drinking is rising across Europe. In France, health authorities report that from 2004 to 2007 the number of young people ages 15 to 24 who were hospitalized in an inebriated condition rose by 50 percent. France has introduced a bill to raise the drinking age for beer and wine from 16 to 18 (*8*).

Legal Strategies

A variety of laws have aimed to improve safety among young drivers. In many countries, graduated licensing has become the dominant strategy. The laws establish a staged licensing system restricting young and novice drivers as to how, when, and under what circumstances they may drive; as they gain more experience, the young drivers are allowed to increase their independence and flexibility.

Three elements contribute most to the effectiveness of graduated licensing: minimum holding periods at each phase of licensure, nighttime restrictions on driving, and restrictions on carrying passengers. Also key are zero-tolerance laws prohibiting any use of alcohol during the learning and probationary phases of licensing (*9*). Graduated licensing and zero-tolerance laws are highly effective in reducing crashes among young drivers—studies consistently show a 12 to 40 percent reduction in crashes among affected drivers (*10*).

A recent study indicates that the risk of alcohol-impaired crashes is reduced significantly by specific state laws, including prohibition of possession of alcohol by those under 21, prohibition of underage purchase of alcohol, use-and-lose laws that impose driver's license penalties on youth convicted of alcohol purchase or possession violations, and zero-tolerance laws (*11*).

Australia's well-structured graduated licensing system sets a minimum age of 17 for licensing young drivers and imposes several specific restrictions not common in other countries. These provisions include a relatively long maximum tenure for learner

PHOTO: NATHANAEL T. MILLER, U.S. NAVY

An exhibit is set up to discourage drink driving at the U.S. Naval Base in Guam; adjusted for exposure, 21- to 29-year-olds have the highest risk for drinking driver fatalities.

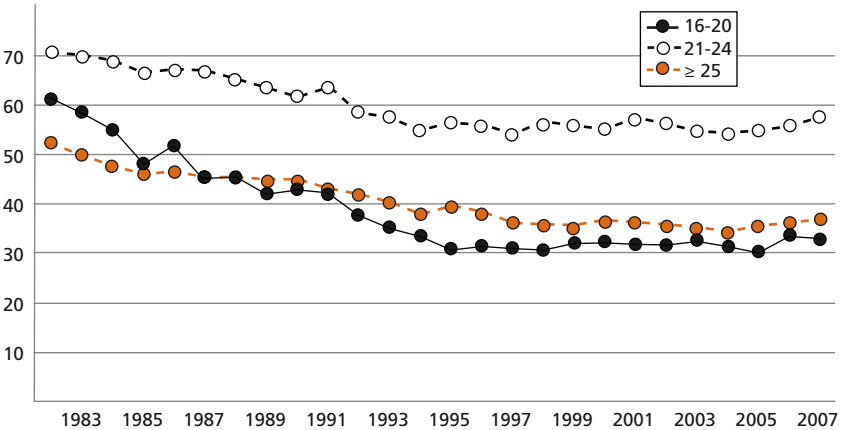

FIGURE 1 Percent of U.S. fatally injured passenger vehicle drivers with positive BAC by age, 1982–2007. [Sources: Fatality Analysis Reporting System (FARS), 1982–2007; Insurance Institute for Highway Safety, 2008.]

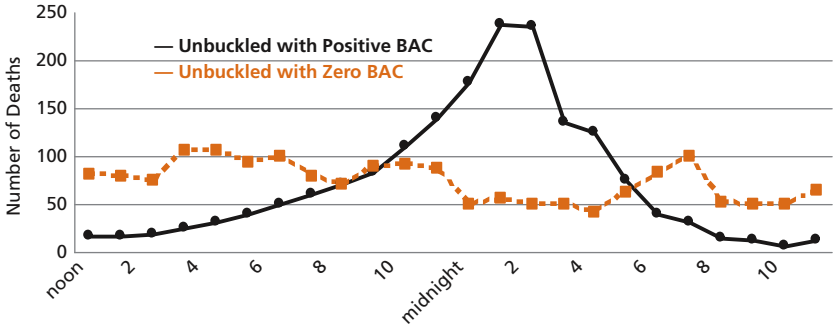

FIGURE 2 Number of U.S. unbuckled fatalities, by time of day, and by presence or absence of alcohol among drivers, ages 16–24. (Source: FARS, 2006 data.)

and provisional licenses, which reduces any pressure for novice drivers to progress to the next stage before the current license stage expires; requirements to display an identifying plate on the vehicle to indicate license status to other drivers, road users, and police; speed restrictions according to license category; and a zero alcohol requirement. The minimum purchase age for alcohol in Australia is 18 (*12*).

In the United States, the minimum drinking age of 21 has been a primary legal strategy for reducing impaired driving among young drivers. Dramatic effects of the higher drinking age have been demonstrated repeatedly on drinking and driving and on other alcohol-related harms. As shown in Figure 1 (page 5), U.S. rates of alcohol-related fatalities have declined in all age groups in the past 25 years, but the rates have declined most dramatically for drivers ages 16 to 20. Moreover, delaying the drinking age until 21 does not cause a rebound effect—patterns of alcohol-related crashes for 21- to 24-year olds are similar to those for 24- to 35-year olds (*13*).

A study of the consequences of the legal change lowering the drinking age in New Zealand from 20 to 18 in 1999 found that traffic crashes and other alcohol-related injuries and problems among youth have increased. Drinking and associated problems have trickled down to 15- to 17-year-olds (*14*).

Role of Enforcement

Enforcement plays a key role in reducing impaired driving among all populations. For example, highly publicized random breath tests and sobriety checkpoints have been effective in reducing impaired driving crashes. The primary effects of enforcement are

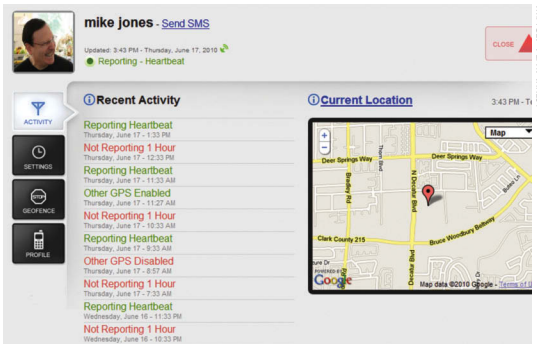

IMAGE: TEXTARREST

Technology can help reduce impaired or distracted driving by controlling behaviors; the mobile application TextArrest prevents phone use while driving and can track a cell phone's movement in transit.

The Impact of Underage Drinking Laws on Alcohol-Related Fatal Crashes of Young Drivers

A recent study evaluated the effects that 10 laws related to alcohol and driving have had on drinking-and-driving fatal crashes among young drivers (*11*). Significant decreases in crashes among young drivers resulted from

- Laws against the possession and purchase of alcohol by persons under the age of 21;
- Use-and-lose laws that impose driver's license penalties for violations of the possession and purchase laws; and
- Zero-tolerance laws that make it illegal for drivers under age 21 to drive with any alcohol in their system.

PHOTO: NHTSA

Research shows that well-publicized sobriety checkpoints—which often involve breath tests to determine BAC—are effective deterrents against impaired driving.

Other laws that aim at all drivers also were found to decrease alcohol-related fatal crashes among young drivers, including

- Laws declaring a blood alcohol concentration of 0.08 illegal per se;
- Primary seat belt laws, which allow enforcement officers to ticket a driver solely for not wearing a seat belt, as well as secondary seat belt laws, which allow ticketing if the driver has committed another citable traffic infraction; and
- Administrative license revocation laws.

The researchers estimated that the two core underage drinking laws addressing purchase and possession and the zero-tolerance law are saving an estimated 732 lives per year. If all states adopted use-and-lose laws, the authors conclude, an additional 165 lives could be saved annually.

to deter illegal behavior—apprehending and punishing violators are secondary effects (*15*).

Recent enforcement campaigns to reduce impaired driving deaths have extended beyond the enforcement of impaired driving laws per se. For example, vigorous enforcement of speed limits in France appears to have reduced crashes among both impaired and sober drivers (*14*).

The enforcement of seat belt laws has similar potential to reduce impaired driving and alcohol-related deaths and injuries. As shown in Figure 2 (page 6), most deaths involving unbelted vehicle occupants in the United States occur between midnight and 3 a.m.—also a prime time for impaired driving. Young drivers have lower seat belt use rates. Nighttime enforcement of seatbelt laws, therefore, can be effective in encouraging seat belt use, as well as in deterring impaired driving (*16*).

Potential of Technology

In addition to enforcement and education to change driver behavior, vehicle design and road design have contributed greatly to progress in traffic safety. Recently developed technologies may enable further progress. Some are relevant to novice drivers, who may lack skills, and to young drivers, who may lack judgment.

The first 1,000 miles of driving tend to be the most dangerous (*17*). In addition, teenage drivers tend to speed more and to use seat belts less than older drivers—behaviors that could be controlled through technology. Technology can improve driving performance through three main channels:

- **Forcing**—designing systems that do not permit dangerous behavior; for example, installing speed governors on the cars of young drivers or preventing driving unless the seat belt is fastened;
- **Feedback**—alerting the driver to dangerous behavior; for example, following too closely; and
- **Reporting**—alerting parents or other authorities when dangerous driving has occurred.

Systems are now available that include some of these features (*18*); others are in development. The most sophisticated systems recognize who is driving the car—the teenager or a parent—and set appropriate limits for the teenage driver. An alcohol interlock may be included to prevent driving after drinking.

Some systems include a data base with Global Positioning System technology that indicates the current driving context—for example, the current speed limit. When the young driver violates the parameters set by parents, the system can report the dangerous behavior to the parents or another authority. For example, if the young driver exceeds the local speed limit, a warning sounds. If the driver does not slow down after the second warning, the parent is notified via text message or telephone. One valuable feature prevents the use of cell phones or entertainment systems while the young driver is driving (*18*).

Continuing the Progress

Young drivers pose a particular danger in traffic from their inexperience and lack of mature judgment. This high risk is exacerbated by impairment with alcohol or other drugs. Some predictable characteristics are associated with young driver crashes, including excessive speed, carrying passengers, and not wearing seat belts.

PHOTO: U.S. DEPARTMENT OF TRANSPORTATION

U.S. Transportation Secretary Ray LaHood hosted the Distracted Driving Summit in September 2010 to focus on a major prevention initiative of his administration. Research shows that the first 1,000 miles of driving tend to be the most dangerous; for young drivers this can be compounded by distractions such as peers, cell phone conversations, and use of electronic devices.

PHOTO: AAAFTS

Traffic law enforcement campaigns such as speed limit enforcement also have had success in reducing impaired driving.

Addressing the Problem of Young Impaired Drivers

TRB's *Transportation Research Circular E-C132: Young Impaired Drivers: The Nature of the Problem and Possible Solutions* provides an overview of the information presented at a June 3–4, 2008, workshop that explored the risks posed by young impaired drivers and how these risks might be addressed. The 254-page document includes technical background papers prepared for the workshop, as well as summaries of discussions. The workshop offered perspectives on the issues from the United States, Canada, Europe, and Australia. *Young Impaired Drivers* is available on the TRB website, http://onlinepubs. trb.org/onlinepubs/circulars/ec132.pdf.

Increased knowledge about the nature of the problem has enabled progress in reducing impairment and crashes among this segment of the population. Legal structures have played an important role—in the United States, raising the drinking age to 21 dramatically reduced impaired driving crashes, as well as other alcohol-related problems. Zero-tolerance laws and graduated licensing systems also have proved effective.

Enforcement ensures the effectiveness of these laws. Although legal structures and enforcement have been effective, newly developed technologies may further reduce risky and impaired driving by young persons.

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PHOTO: AAAFTS

Historically, the number of drink driving crashes has been reduced by legal measures such as raising the drinking age to 21, zero-tolerance laws, and graduated licensing systems.

Workers tie reinforcing steel for the Shields Avenue bridge over the new I-40 alignment, with downtown Oklahoma City in the background.

PHOTO: OKLAHOMA DOT

Realigning the I-40 Crosstown Expressway in Oklahoma City

Coordinating and Collaborating on a Megaproject

JOHN R. BOWMAN

The author is Assistant Planning and Research Division Engineer and I-40 Crosstown Project Development Engineer, Planning and Research Division, Oklahoma Department of Transportation, Oklahoma City.

The Oklahoma Department of Transportation (DOT) is realigning an urban Interstate facility that passes through the center of Oklahoma City. For this megaproject, Oklahoma DOT has established cooperative agreements with many partners within the community and has developed closer working relationships with the transportation industry. Through these agreements and relationships, the agency has moved forward expeditiously with the realignment and has realized savings and benefits.

The original Interstate 40 in Oklahoma City was designed and built in the early 1960s. Known as the Crosstown Expressway, the segment was state of the art in design and function. Nearly 50 years later, however, the elevated Interstate facility no longer can meet traffic demands.

Oklahoma DOT is maintaining traffic on the facility while constructing an offset alignment along a transportation corridor. This has required the cooperative efforts of Oklahoma City, railroad companies, and the general public. When traffic is routed onto the new facility in 2012, the old alignment will become a city street, providing the primary access into downtown Oklahoma City.

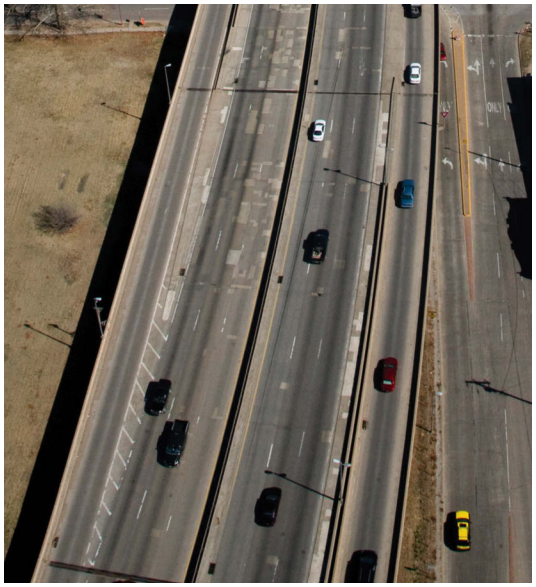

PHOTO: OKLAHOMA DOT

The I-40 Crosstown Expressway before the realignment project's start-up; the 50-year-old facility carries a daily traffic volume of more than 119,000 vehicles but was designed for 76,000. When the new facility opens in 2012, the old alignment will become a city street, providing the primary access into the downtown.

Photo: Oklahoma DOT

Aerial view of the I-40 twin bridges—the longest in the state—showing the limited shoulders. Undamaged steel beams from the bridges will be used to rehabilitate county bridges throughout the state.

Bridge Problems

Bridge elements in the elevated portion of the Interstate have been experiencing problems. As early as 1989, Oklahoma DOT recognized significant issues with the I-40 Crosstown Expressway bridges. Extending more than 8,880 feet, the twin bridges are the longest in the state.

In 1989, a span of one bridge settled slightly. Consisting of small beams approximately 33 inches in depth, the span had pulled the anchor bolts from the concrete pier cap, shifted the bearings, and settled.

Investigation revealed that the pin-and-strap hangers, which served as the expansion devices on the bridges, had failed to provide sufficient movement at the expansion joints. This forced the movement to occur at the pier, where the 33-inch-deep beams met significantly deeper beams. An emergency repair project installed a retrofit expansion device that replaced the pin-and-strap hangers at two locations.

At approximately the same time, a crack was discovered in a fracture-critical beam near the west end of the south structure. The beam was repaired under an emergency contract but raised concern about the 289 other fracture-critical beams in the two bridges. An inspection regime was instituted and is ongoing.

Frequent punch-through failures occur on the decks of the bridges. On average, Oklahoma DOT closes lanes on the bridges 17 times a year to repair the holes. The emergency repairs and the routine scheduled maintenance on the bridges cost approximately $1 million a year to keep the structure safe and open to traffic.

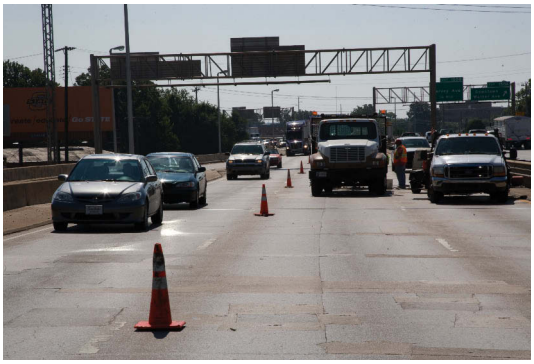

Photo: Oklahoma DOT

Repairs to the Crosstown bridge decks require lane closures an average of 17 times a year.

Several other features on the I-40 facility no longer meet design criteria. Shoulders on the bridges are too narrow to provide refuge to stranded motorists. Entrance and exit ramps do not provide sufficient length for acceleration or deceleration, respectively. Ramp spacing is inadequate. Moreover, six of seven segments of the facility are rated critically high for crashes. These problems, along with a daily traffic volume of more than 119,000 vehicles on a facility designed to carry 76,000, led Oklahoma DOT to expedite construction of the new facility.

Investigating Solutions

Late in 1995, Oklahoma DOT contracted with MacArthur Associated Consultants to complete a Major Investment Study (MIS) and Environmental Impact Statement (EIS) for the Crosstown. The department selected a staffer to shepherd the project through the environmental clearances.

The MIS and EIS efforts investigated potential solutions to the facility's problems. Oklahoma DOT used a two-tier evaluation system to narrow the field of seven potential alignments to a locally preferred alternative—known as Alternate D—in December 1998. The department invited partners in Oklahoma City to conduct a planning study to determine the impacts of the preferred alternative on the fabric of the city.

The study, *The I-40 Relocation Land Use and Mitigation Plan*, was completed in early 2000. The document detailed measures to mitigate the impact and to blend the new facility into Oklahoma City.

Working with Oklahoma City staff, as well as with representatives of the community through an extensive public outreach and education process, Oklahoma DOT incorporated certain measures from the city's plan into the Crosstown project. The mea-

sures included the creation of a neighborhood park, installation of a dedicated pedestrian bridge over the Interstate, inclusion of aesthetic treatments reflecting the architectural details of a neighborhood church, and the construction of a boulevard on the old Interstate alignment.

Community Input

The cooperative efforts in blending portions of the community input into the project as mitigation measures, and in informing the public, paid great dividends. During the public comment period on the draft EIS, Oklahoma DOT received a total of only 64 comments, although the comment period was extended for 90 days. More than half of the 64 comments opposed the realignment strategy.

An urban Interstate project of this magnitude, however, would have been expected to generate a larger volume of significant opposition. The department's efforts to inform the public and build consensus within the community had a positive effect.

With the success of the environmental process, Oklahoma DOT quickly produced the final EIS and received the Record of Decision from the Federal Highway Administration (FHWA) in May 2002.

Acquiring Rights-of-Way

Oklahoma DOT proceeded with the design and right-of-way acquisitions. The department had a contract for engineering studies with MacArthur Associated Consultants to refine the studies for the selected alignment and to produce plans for the alignment, grades, lane configurations, and right-of-way limits.

The right-of-way acquisition for the corridor commenced in July 2002. The Right-of-Way Division began by prioritizing the acquisition of all residential properties, then turned to commercial and industrial properties, and finished with negotiations on rail properties. Because of the demographics of the area, all of the right-of-way documents were provided in English and Spanish, and the negotiations also were bilingual. Oklahoma DOT and the service provider maintained an office within the corridor during the acquisitions.

Each property acquisition allowed time for the negotiations to develop and afforded flexibility in establishing the dates for vacating. The department acquired 54 residential properties; only one owner was subject to eminent domain.

The condemnation rate for commercial and industrial properties was somewhat higher than for the residential properties, in part because Oklahoma City imposed a moratorium on new billboards along the I-40 Crosstown Expressway. Many of the business properties that had included billboards found it difficult to relocate within the corridor, complicating the negotiations.

Design Teams

Oklahoma DOT devised a plan to contract with several design engineering firms (DEFs) for the new Crosstown Expressway. This decision reduced the delays associated with having a single firm develop the entire design.

The department identified four distinct geographic segments with unique design characteristics within the corridor and selected four design teams to develop the alignment design concurrently: Poe and Associates, Carter-Burgess, Cobb Engineering Company, and the Benham Companies. In mid-2003, the department selected MacArthur Associated Consultants as the project management consultant (PMC).

Aerial view of Union Pacific Railroad's shoofly tracks.

PHOTO: OKLAHOMA DOT

Phased Approach

The new alignment presented a challenge for phasing and sequencing the construction. Three rail companies operated on four distinct lines within the corridor, requiring railroad shoofly alignments—that is, temporary tracking to bypass the work area—access to rail customers, and through-movements.

In addition, the proximity of the corridor to the Oklahoma River limited the number of surface streets available to the traveling public for north and south access through the area, affecting the number and duration of street closures at any one time. Moreover, financial resources were not available for constructing vast segments of the corridor.

Photo: Oklahoma DOT

Phased construction for Pennsylvania Avenue over the Union Pacific Railroad.

The department decided on a phased approach with multiple construction contracts. This approach risked creating site-access conflicts for contractors or time-dependent interactions between contractors. Oklahoma DOT therefore developed a segmented approach to constructing the corridor.

To ensure that a contractor would be separated geographically from other concurrent contracts, Oklahoma DOT identified and planned for 18 distinct construction contracts, or work packages, within the corridor, including those necessary to construct the boulevard access into downtown Oklahoma City. The number expanded to a maximum of 25 projects but ultimately settled at 23.

Each geographical area for an engineering contract was the site of multiple construction projects, with some elements overlapping into adjacent sections. Each DEF area was designated with a number, 1 to 4, to indicate its priority for construction. Each section contained individual construction work packages, each of which also received a sequence number.

The photograph at left shows the phased approach for constructing Pennsylvania Avenue over the Union Pacific Railroad (UPRR). Because of the proximity of the rail line to the new line, only a portion of the project could be constructed until UPRR transferred to its new alignment.

Defining Goals

In May 2004, after selecting the project team and defining the projects, Oklahoma DOT, in conjunction with FHWA, conducted the I-40 Crosstown Expressway Accelerated Construction Technology Transfer Workshop. The workshop established 22 goals, with the theme of completing the project as quickly and efficiently as possible.

Approximately 75 national and local experts convened in Oklahoma City to dissect the project and develop recommendations in eight main skill-set categories. The intensive workshop produced 127 recommendations, many of which were implemented. The recommendations saved more than $10 million and a significant, but undefined, amount of time.

One recommendation was for the early completion of geotechnical testing. This step provided Oklahoma DOT with information for grade and design adjustments to conditions before significant design efforts commenced.

Another recommendation was for a single resident engineer to oversee the construction contracts. Oklahoma DOT modified the recommendation and appointed a construction contract coordinator to facilitate the efforts of three resident engineers in the field.

The I-40 Crosstown Expressway project—here shown in September 2009—has proceeded in well-planned and well-orchestrated phases.

Photo: Oklahoma DOT

Design Solutions

As the four DEFs were beginning the initial designs, each was tasked with assisting Oklahoma DOT in a value engineering study for the corridor, looking at the elements that made up the bulk—or approximately 75 percent—of the anticipated construction costs. The study produced 17 recommendations with potential savings of approximately $26 million; the recommendations deemed appropriate for implementation projected a savings of approximately $14 million.

Design then began in earnest in each of the sections. The center portion of the corridor was to be semidepressed, resting approximately 8 to 10 feet below natural grade to minimize the impact on the crossing city streets and on the surrounding areas. Oklahoma DOT and consultants decided to increase the depth of cut for this section of the alignment to approximately 18 feet below the natural grade. This would eliminate most of the embankments for crossing streets.

Drainage calculations, however, indicated that a 100-year local rainfall event, if coupled with a 100-year flood on the Oklahoma River, would cause storm water to pond on the shoulder of the Interstate. Early geotechnical investigations also indicated that a lens of clay material, located just below the subgrade elevation of the new pavement, would not interact well with the roadway.

In addition, the elevation placed the subgrade close to the projected future groundwater elevation. Groundwater in this area was rising after the recently completed impoundments of the Oklahoma River through downtown Oklahoma City. The department therefore reevaluated the grades of the Interstate and decided to return to approximately the elevation anticipated in the environmental clearance process.

Oklahoma DOT began coordinating the construction contracts while the consultant engineering firms started on the design of the new alignment. Employing multiple contractors on a single alignment for a period of years is a complex task, and conflicts and claims would be likely without careful planning of the phasing and sequencing.

Coordinating Construction

Oklahoma DOT surveyed local and national construction firms to determine the most common critical path method (CPM) scheduling programs in the industry. The survey found that a majority used a single program—or programs compatible with it; the department therefore applied this program for sequencing the work. In consultation with FHWA, Oklahoma DOT produced a Public Interest Finding, specifying that all contractors in the corridor must use the program.

PHOTO: OKLAHOMA DOT

Grading and structure work on central portion of the corridor.

As the PMC, MacArthur Associated Consultants developed and maintained the master, or programwide, schedule. Each contractor submitted an electronic file of its updated CPM to Oklahoma DOT every month. The files were then inserted into a master schedule. Activities that crossed project boundaries or that had an effect on adjacent projects were monitored to assure construction without interruptions.

In addition, the master schedule allowed the department to identify potential conflicts, to adjust the components of work packages, and to define specific milestone activities within those projects to eliminate or minimize conflicts. With the master schedule, the department could anticipate letting dates and could specify submittal dates for project plans in development.

The tool also made it possible to run what-if scenarios for the sequencing of work package lettings with respect to construction contracts already under way. The photograph above shows construction on the grading and structures within the center portion of the project, one of the 23 projects to complete the realignment.

Partnering with the City

Information from the CPM also assisted Oklahoma City. The master schedule allowed for the department to provide Oklahoma City with relatively accurate and consistent information about road closures. Oklahoma City then informed the public about anticipated road closures and the durations.

Additional coordination with the city assisted with project phasing to minimize the number of city street closures at the same time. Because of the railroads and the Oklahoma River, only a limited number of streets crosses the corridor; coordination of street closures with the city, residents, and businesses therefore was important.

Photo: Oklahoma DOT

Aerial view of Pennsylvania Avenue, which has been closed to traffic since November 2007.

Utilities Relocation

Several city utilities—water lines, sanitary sewer lines, and storm sewer lines—required adjustment because of the realignment project. Oklahoma DOT advises local agencies to complete the necessary utility relocations before advertising a project for letting. Because of the depth of the utilities, the number of conflicts, and the goal of minimizing the impacts on the traveling public, however, the department and the city agreed to include the relocation of utilities in the construction contracts.

The PMC developed a corridorwide utility relocation master plan to continue services during the phased construction. Oklahoma DOT instructed the DEFs to work directly with city staff in designing the utilities. Plans were developed to city standards and then incorporated into the construction plans for the work package. The department did not close streets during the early utility relocations, adding flexibility in the letting schedule by avoiding delays before construction.

Oklahoma DOT's utility relocation master plan assisted with a host of other utilities within the 5-mile-long corridor. Fiberoptic companies typically place lines within railroad rights-of-way, taking advantage of the stability and control of the corridors. Oklahoma DOT and the PMC worked with the fiberoptic companies to formulate and implement relocation plans that allowed for continuous operation, redundancy, and minimal impact on the construction schedule.

Aesthetic Treatments

The corridorwide plan benefitted the aesthetic treatments, which afford the traveling public a pleasant and attractive approach to Oklahoma City. During the environmental clearance process, Oklahoma DOT made a commitment to construct retaining walls with an architectural similarity to Little Flower Church in the center of the project.

Built in the 1920s, Little Flower Church is a landmark of the Riverside neighborhood. Oklahoma City and a group led by Oklahoma City Beautiful originally suggested aesthetic treatments evocative of the church—they sought a strong statement, but with a clean, simple, and classic design.

A committee of representatives from Oklahoma DOT, Oklahoma City, Oklahoma City Beautiful, and community groups worked for several years to develop aesthetic guidelines for the DEFs in the corridor designs. Additional input suggested that an art deco style would satisfy the requirements. The final treatment plan for the central portion of the alignment can be seen in the rendering on page 15.

SkyDance Bridge

The rendering includes a depiction of SkyDance Bridge. One of the mitigation measures adopted by Oklahoma DOT was a pedestrian bridge, to be built over the new I-40 alignment. The department had planned a landscaped pedestrian bridge similar in size and design to the other bridges within the corridor. Oklahoma City, however, envisioned a more iconic structure—with the redevelopment of the entire downtown area, the city sought a more striking, symbolic feature.

Through a design competition, Oklahoma City chose the SkyDance Bridge, which represents the flight of the scissortail flycatcher, the state bird. Although the city wanted to pursue the construction of the bridge as its own project, the interfaces with the Interstate were significant. The city, Oklahoma DOT, and their consultants therefore worked together to plan installation without adverse effects

on the construction of the Interstate and railroad facilities. Measures included coordinated plan reviews and information sharing.

Collaborative Solutions

Oklahoma DOT and Oklahoma City coordinated efforts on several other concurrent projects. The city started on the redevelopment of the state fairgrounds as the I-40 project was preparing to begin. One of the fairgrounds projects was expected to produce a large volume of excavation material; a project in the nearby I-40 work package required the use of borrow material. Oklahoma City, Oklahoma DOT, and FHWA reached an agreement to use the city excavation material on the alignment, reducing haul costs and providing the department with borrow material—hard to find in the metropolitan area.

Oklahoma DOT obtained 300,000 cubic yards of material from another Oklahoma City project approximately 2 miles from the I-40 realignment. Again this saved the city the cost of disposal and the department the cost of contractor-obtained borrow material. The collaborative relationship that has developed between Oklahoma DOT and Oklahoma City has benefitted the taxpayers of Oklahoma.

One of the main tasks of the I-40 Crosstown Expressway project is the removal of the 8,880-foot bridge structures. The removal will generate approximately 1,700 steel beams with a usable length of 50 feet. The beams, mostly 33-inches and 36-inches deep, will not be of use to Oklahoma DOT.

Working with the Association of County Commissioners of Oklahoma, however, Oklahoma DOT will make the undamaged beams available for rehabilitating county bridges. The condition of Oklahoma county bridges has long been a serious problem, and the arrangement will benefit users of the county road networks.

Photo Courtesy of Oklahoma DOT

Architectural details from Little Flower Church, a landmark of Oklahoma City's Riverside neighborhood, yielded art deco models for the I-40 treatments, adapted by the four design teams.

Benefiting Generations

Major transportation infrastructure projects offer significant opportunities for all involved parties to reach new and unique solutions to longstanding problems. Working closely with the community during the environmental process affected and guided the location, look, and feel of the new alignment for the I-40 Crosstown Expressway. Cooperation and coordination with railroad companies opened the new alignment.

Oklahoma City and Oklahoma DOT saved time and money through the planned use of materials on nearby projects, and the counties of Oklahoma will improve the county bridge system as construction of the newest realigned metropolitan Interstate moves forward. The results of these efforts will benefit generations to come.

Photo: Oklahoma DOT

Rendering of the aesthetic treatments for I-40, with a view of the SkyDance pedestrian bridge.

RECONSTRUCTING AN AGED EXPRESSWAY IN THE HEART OF ST. LOUIS

Missouri's Measured, Model Approach

LINDA WILSON

PHOTO: MISSOURI DOT

The construction schedule of the New I-64 project involved complete closures of all lanes in both directions of the west portion and then the east.

The author is Community Relations Manager, Missouri Department of Transportation, St. Louis Office, Chesterfield.

Interstate 64–U.S. Route 40 is the oldest highway in St. Louis, Missouri, dating back to the 1930s. Originally designed for cars traveling at 30 mph, the Interstate resembled a parkway as it meandered east and west through the heart of St. Louis. By 2000, more than 150,000 vehicles traveled on the highway daily at speeds in excess of 60 mph.

By then, the highway and its 30 bridges had deteriorated and had become outdated—replacement was necessary to improve safety and capacity and to meet Interstate standards. Limited funds, limited space, and the need to complete the project quickly to limit the impacts of the construction complicated the Missouri Department of Transportation's (DOT) planning for rebuilding the highway.

Scope and Resources

The New I-64 Project involved the complete reconstruction of approximately 10 miles of I-64 in the St. Louis metropolitan area. This included 13 interchanges—one a freeway-to-freeway connection with I-170; eight major overpasses or other bridges; and the removal and replacement of the mainline pavement between Spoede Road in St. Louis County and Kingshighway Boulevard in the City of St. Louis.

With an original budget of $535 million, the New I-64 Project was the largest construction contract awarded by Missouri DOT and its first design–build project. Groundbreaking took place in March 2007. The first phase of the project included the construction of new direct-connect ramps from I-64 to I-170. Reconstruction also began on several interchanges and overpasses.

In January 2008, the second phase began with the closing of the western 5 miles of the project corridor, diverting all traffic to other roadways. During 2008, all lanes of the old highway were torn up and crushed, and new concrete pavement was installed. Despite record-setting spring and summer rains, the western 5 miles reopened to traffic two weeks ahead of schedule, on December 14, 2008. Work began immediately on the eastern 5 miles of the project. Again the highway was closed to traffic, and the complete reconstruction began.

The eastern half also finished early, reopening to traffic on December 7, 2009, three weeks ahead of schedule, and $11 million under budget. The final tasks on the punch list were completed in July 2010.

PHOTO: MISSOURI DOT

Built in the 1930s, the parkway-like U.S. Route 40, now I-64, was designed for cars traveling at slower speeds than today; (*below:*) the McKnight overpass in the early 1940s.

Design–Build Procurement

A New Model

The New I-64 was Missouri DOT's first design–build project and largest highway reconstruction project. Because early estimates indicated that the project cost would exceed the available funds, Missouri DOT

implemented a flexible procurement process to allow for creative innovations in contractor bidding.

The normal approach by DOTs for design–build contracts involves a fixed scope, based on set state standards, and the competition hinges on the price. For I-64, Missouri DOT provided the competing teams with a fixed-cost, flexible scope process. The competing teams could identify which federally approved state standards they would use.

Missouri DOT made its selection based on how well the contractor reached the department's six goals for the project. The goals included completion on time and on budget, building the maximum amount of improvements with a service life of 50 years, handling traffic and communicating with the public to minimize the impacts, and creating a new model for design–build.

Missouri DOT pulled together several sources of funding for the project and issued a Request for Qualifications in 2005. Two teams emerged. In 2006, the Request for Proposal began by asking, "We have $420 million to pay for design and construction. How much can you build with that?"

Creativity and Flexibility

States ordinarily stipulate how to handle traffic during construction. With I-64, Missouri DOT only said that the contractor could not close the entire 10 miles for the duration of the construction project. The agency directed the contractors, "Tell us how you will construct the project and how you will keep traffic moving around the region." The final proposals, submitted in October 2006, revealed how the flexible process would translate into getting the most for the project with the available funds.

The proposal from Gateway Constructors maximized the creativity and flexibility that Missouri DOT sought for developing a project that would deliver the most quality improvements to I-64 as quickly as possible and with the least cumulative impact on traffic.[1] The team's approach to construction included complete closures of 5 miles of the Interstate at a time for two years. The proposal offered all of the improvements in Missouri DOT's original scope minus one-half mile at each end of the project.

Almost 10 miles would be rebuilt, including 13 interchanges and eight other major bridges and overpasses. The proposal set forth an aggressive, proactive plan for handling traffic and made a commitment to assemble a workforce that reflected the community.

[1] Gateway Constructors was a joint venture of Granite Construction, Inc.; Fred Weber, Inc.; and Millstone-Bangert, Inc., with Parsons as lead designer.

PHOTO: MISSOURI DOT

Missouri DOT broke ground on the New I-64 project in March 2007. The department's largest construction project—and its first design–build endeavor—had a budget of $535 million.

Schedule

Under the flexible scope approach, Missouri DOT allowed the contractor to develop its own schedule. The agency provided two parameters: the project had to be completed no later than October 1, 2010, and the contractor could not close the entire 10 miles of the highway for the entire 4 years of construction. Gateway Constructors targeted a completion date of July 31, 2010, exceeding Missouri DOT's original goal by three months. The schedule was divided into four phases over the four years of 2007 to 2010.

The first year included closing some of the cross-street bridges, with some off-peak closures at the I-170 and I-64 interchange and the I-64 and Kingshighway interchange. The second year called for the complete closure of I-64, all lanes in both directions, from I-270 to I-170. In the third year, the other 5 miles of I-64 from I-170 to Kingshighway were completely closed. In 2010, the final year, only minor off-peak closures were planned for any clean up and punch-list items.

PHOTO: MISSOURI DOT

Pavement from the old highway was torn up and crushed during the New I-64 project, recycled, and used in the new highway.

PHOTO: MISSOURI DOT

A web page for the New I-64 project featured up-to-date construction and traffic information, project updates, photos, maps, drawings, flyers, and more. Customers could communicate with Missouri DOT staff and ask questions using a "Question of the Week" module.

This approach was simpler to communicate, was safer for the public and for the workers, and kept to a minimum the disruptions on local streets from the construction. The work, including dirt moving and the concrete batch plant, focused on the closed section of the highway.

Missouri DOT worked with Gateway Constructors to provide an incentive for exceeding the key schedule commitments. The first incentive was an award of $2 million for reopening the western 5 miles of I-64 to traffic by December 31, 2008. A second $2 million was available for the reopening of the eastern 5 miles of I-64 to traffic by December 31, 2009. Gateway exceeded the first goal by two weeks and the second goal by more than three weeks to earn the incentives.

Public Information and Outreach

One Team, One Voice

The project's public information efforts, shared by Missouri DOT with its subconsultant HNTB and by Gateway Constructors with its subconsultant Vector Communications, set new standards for providing construction information to the traveling public. The team of five public relations professionals worked in the project office to develop and implement extensive communications and community outreach.

Although the team members represented the agency, the contractor, and consulting firms, information flowed through a seamless process involving all. Gateway was responsible for communicating with the public about the project's progress, maintaining daily updates on traffic issues and construction, as well as supplying information about coping with the changes. Missouri DOT and HNTB were responsible for communicating the big picture and the project's vision. The communications addressed concerns about regional mobility—including hospital and emergency access—for large businesses and employers, mom-and-pop operations, public and private schools, regional attractions, and everyday commuters and shoppers.

Public Meetings and Speeches

The New I-64 team participated in hundreds of neighborhood and business group meetings to discuss the project and its progress. The earliest public hearings took place in 1999 and continued throughout the design and environmental phase, between 2000 and 2005. General public meetings were held at the beginning of 2007 before the start of construction.

Additional meetings were held in late 2007 and 2008 to discuss the highway closures, which began in January 2008 and December 2008. The New I-64 Public Information team delivered more than 300 speeches to major employers, business associations and corporations, neighborhood associations, town hall meetings, schools, chambers of commerce, and other groups between 2007 and 2009, reaching approximately 30,000 customers.

Digital and Social Media

The project website, www.thenewi64.org, posted timely and accurate information on construction activities and schedule changes affecting traffic. Customers could sign up for project updates that were e-mailed weekly or at the approach of a major milestone. Photos of the project, maps, drawings, flyers, and other information were updated regularly to reflect the project's progress and the changing hot-button topics.

A "Question of the Week" module was created to survey the public about alternative routes, travel plans, and thoughts about project-related items or events. The website received 40,000 to 100,000 visits per month, depending on the time of year. The project team received thousands of e-mails via the website, answered promptly, and followed up.

The I-64 Community Relations Team hosted a weekly chat room on the website of the *St. Louis Post-Dispatch*. Beginning in November 2007, Missouri DOT and Gateway Constructors' public relations managers cohosted a weekly chat, "I-64 Live," the first nonstaff chat room the newspaper had coordinated. The discussions were the newspaper's second busiest chat room, after the one for sports.

On average, the team answered 25 to 50 questions

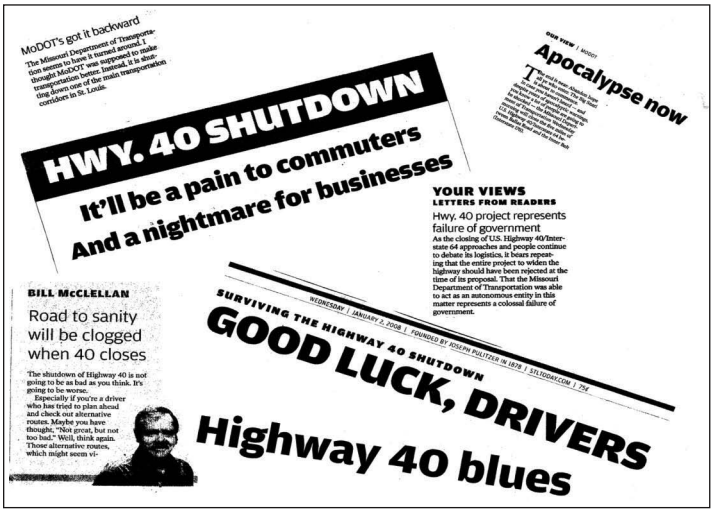

PHOTO: MISSOURI DOT

The controversial nature of the I-64 closures guaranteed media attention. At left, a collection of local headlines before the January 2008 closure; at right, a collection of headlines after the closure.

in one hour every Wednesday afternoon until the end of construction. The Monday print edition of the paper published excerpts of the questions and answers, making highlights of the conversations available to all print subscribers. Because of its success for the paper and Missouri DOT, the chat room has continued after completion of the I-64 project as "The Road Crew," hosted by Missouri DOT, St. Louis City, and St. Louis County. The weekly session fields more than 50 questions each week about road issues in general.

Taking advantage of the emergence of social media and the potential to reach a more diverse audience, the New I-64 team started a Facebook page in 2008. The page helped the team build project awareness, as well as drive visitors to the New I-64 website. Missouri DOT also used Flickr and YouTube to post videos and photos of the project. Through this multiplicity of outreach tools, the team was able to reach more audiences.

Media Relations

Media relations were a major part of a constant and transparent communications plan. Public information managers from Missouri DOT and Gateway Constructors engaged the media weekly and sometimes daily.

Because the project was controversial, the St. Louis news media were interested from day one. All of the television, major print, and radio media of St. Louis covered the November 17, 2006, meeting to select Gateway Constructors.

Measuring Results

Before the closure of I-64 in January 2008, local headlines screamed, "Apocalypse Now!" and "Traffic Nightmare!" Some publications named the upcoming event "Carmageddon."

For the first two weeks of each of the two major closures, Missouri DOT implemented a 24 hours per day, seven days a week Incident Command Center. The agency and its transportation partners held daily news conferences to share information from each rush period. The news conferences focused on the most recent rush hour and the changes that motorists might want to consider to improve their travel times. The sessions also suggested alternatives to cope with the closure, such as public transit, carpooling, and flextime.

The media covered the news conferences extensively, and the public responded. Motorists used the recommended resources for traffic information and found alternative routes. Businesses offered flexible schedules to their employees and location or delivery options for their customers.

PHOTO: MISSOURI DOT

Then-Missouri DOT Director Pete Rahn answers questions at one of the daily press conferences in the first two weeks of highway closures. Before each section of I-64 was shut down, Missouri DOT operated a round-the-clock Incident Command Center and established daily communication with the public and the media.

PHOTO: MISSOURI DOT

A board kept a countdown to the end of the project, and changeable message signs posted information about road closures.

Despite the complete closure of 5 miles of I-64, the region's traffic continued to flow—in some areas better than it had before the closure. Volumes increased on the alternative roads, but incremental changes made to the signal timing on key arterials fine-tuned the trouble spots, and travel times stayed constant. In some of the areas that experienced the greatest impact, commutes were no more than 25 percent longer than before the closure. In ongoing surveys of motorists and stakeholders via the website and mailings, 90 percent of respondents indicated that they were well informed about the closure.

The headlines immediately after the January 2 closure read, "Region's Traffic Nightmare a No-Show," and "Preparation Pays Off." The communication efforts worked.

Regional Traffic Flow

Preparing the Region's Roads

During 2007, the first year of construction, I-64 remained open. This gave Missouri DOT time to prepare the region's road system for the traffic pattern changes during the project. The agency was able to complete other projects already under construction on the alternative routes. Engineers examined all the projects within the St. Louis core area and began a push to finish the work before the first section of I-64 closed.

Missouri DOT striped an additional lane in each direction on I-70 and I-44, the two major parallel Interstates. Signals were upgraded on all of the state's major parallel arterials that would serve as alternative routes. In 2007, St. Louis County worked on preparing its alternative routes for the extra traffic. For the first time, Missouri DOT, county, and city engineers worked as a team to coordinate signal systems and prepare for the closure.

Missouri DOT partnered with St. Louis County to develop an arterial street motorist response team. The county wanted to duplicate Missouri DOT's Interstate Motorist Assist program, in operation since 1992. Because all streets had to be able to carry the maximum flow of traffic during the I-64 closure, a blocked lane caused by a flat tire or a crash on an arterial street could have a major impact on traffic.

St. Louis County contracted with Missouri DOT to buy the trucks and to staff a team to patrol all of the county and state arterials adjacent to I-64. The I-64 Traffic Response Team began service in November 2007 and closed down in December 2009. A final evaluation determined that the program achieved a benefit-to-cost ratio of 8.3 to 1; a reduction of 183 secondary crashes per year, with a potential annual social benefit of $4,980,468; a reduction of $1,034,000 in annual congestion costs; and a reduction in the use of emergency resources for traffic response, freeing up personnel for other community needs.

Developing Regional Partnerships

Closing an Interstate for two years generated concerns across a spectrum of audiences. Missouri DOT staff engaged in a broad outreach to all of the major users of the road system.

Emergency response was a primary concern. Passing through the middle of St. Louis, the 10-mile I-64 project directly or indirectly affected 10 hospitals. How would emergency responders reach fires quickly or transport patients needing urgent care to the facilities? In 2006, Missouri DOT began a series of meetings with the emergency responders—police, firefighters, and emergency medical services—serving St. Louis County and the city.

Missouri DOT's district engineer and the I-64 project director also began meeting regularly with the presidents of the 10 hospitals to discuss issues and to form alliances. By listening to concerns and working with core emergency audiences, Missouri DOT developed a team approach to finding solutions.

Missouri DOT staff also visited all of the major school districts, school bus companies, and private schools to discuss the plan for the construction and the alternative routes to keep school traffic moving. Some of the private schools created carpools for the first time and developed a satellite parking lot with shuttles to encourage carpooling.

Missouri DOT worked to develop a we-are-all-in-this-together mentality. The message was that everyone would feel the impact, but if all looked at what they could do to improve the situation, St. Louis would be able to handle the problems.

Maintaining Traffic

The early 2007 meetings with emergency responders and traffic engineers developed into a twice-monthly meeting about the maintenance of traffic, hosted by the contractor at the project office. The meetings reviewed the upcoming schedule, the details of each closure, and how to handle the traffic. Attendance averaged 30, including representatives from the hospitals, the police, and the fire departments of the six municipalities closest to the project; the St. Louis City and St. Louis County highway departments; and the city public works department.

In addition to concerns about safety in the work zone, the group discussed signal timing adjustments on the alternative routes and worked to develop detour routes for every closure, small or large—from a ramp or an overpass to a major interchange or Interstate segment.

Closure Command Center

Missouri DOT treated the I-64 closure as a planned incident and followed the National Incident Management System protocol. The New I-64 Closure Command Team ensured that Missouri DOT and its partners were knowledgeable about the condition and operations of the region's transportation system, actively managing travel reliability, and communicating conditions to the public. The team's success would be measured by travel times no more than 50 percent longer than in preclosure conditions.

Computer sensors were installed to collect data, and teams drove along the routes to verify the travel times. A team of traffic engineers from Missouri DOT, Gateway Constructors, St. Louis County, and St. Louis City developed a system for traveling and monitoring the major routes, discovering bottlenecks, and making improvements. Debriefing and brainstorm sessions developed solutions to be implemented before the next rush period.

Messages through the media called on the public to make changes based on the observations, and the public responded. In some of the areas most affected, commuting times were no more than 25 percent longer than before the closure. Travel times on the Interstates and arterial roadways were predictable under normal conditions. In a survey of motorists and stakeholders, 90 percent responded that they were well informed about the closure.

The team used the travel times for each rush hour to evaluate how the system was handling the change in traffic. At twice daily briefings, team members shared the results from each rush hour and discussed possible adjustments for the next. After the first month, the briefings were reduced to twice a month. Travel times were monitored and compared with preclosure travel times and with the benchmark goal of holding any increase in travel times to less than 25 percent.

Results

Interstate 64 closed on January 2, 2008. The region's traffic continued to flow—in some areas better than before the closure. Incremental changes in signal timing on key arterials served to fine-tune the trouble spots.

Problems were identified, evaluated, and solved—often within hours of first notice. Motorists used the traffic information resources developed by the team to find the recommended alternative routes. Businesses offered flexible schedules to their employees and location or delivery options for their customers. Surveys, mobility studies, and tests showed that freeway travel times in the region were similar to those recorded the previous year, a confirmation of the team's success.

St. Louis residents expressed satisfaction with the way traffic was handled during the New I-64 Project. In a final mailed survey after the highway reopened, 90.4 percent of respondents agreed that the work zone signs placed throughout the project were understandable and accurate. A majority of the community responded that traffic flowed well within the work zones: 77.4 percent were satisfied, and 76.7 reported that they could move around the rest of the St. Louis area well during the closure.

The project caused few changes in how people commuted. The survey after the opening asked how long most trips in the area took after the project was completed compared with the times before construction began. The results showed that 58.2 percent noticed a significant improvement—defined as

Photo: Missouri DOT

Traffic engineers from St. Louis County, St. Louis City, Gateway Constructors, and Missouri DOT formed a team to monitor routes and make improvements to problematic traffic areas.

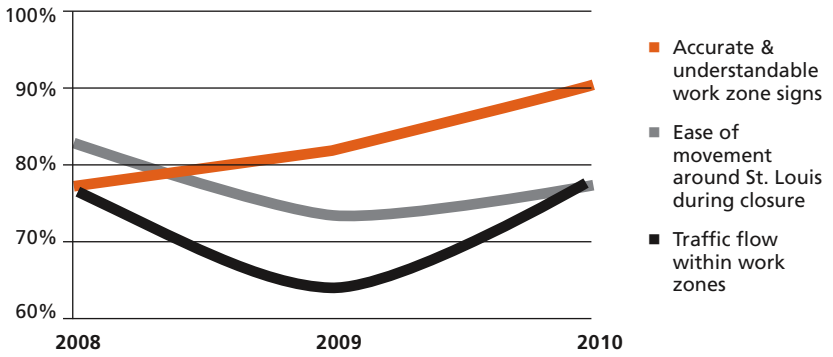

FIGURE 1 Customer satisfaction with traffic management during the New I-64 Project, 2008–2010. (Source: The *New I-64 Economic and Regional Mobility Study*, Heartland Market Research, 2010.)

more than 5 minutes faster—in travel time, and 38.1 percent did not notice a significant change.

Tracking Success

In late 2007, the I-64 Leadership Team examined the characteristics of a successful project and developed a list of 13 tangible results built around the community's expectations, as well as the team's. The expectations determined performance measures for assessing the results, which were reported in a document called the I-64 Tracker. The team tracked the project's progress and charted improvements during the construction and afterward.

Feedback from Stakeholders

Throughout the New I-64 Project, Missouri DOT received extensive feedback from the community. Some of the feedback was not positive, but the agency used the criticisms to make sure that the team's actions were benefiting the region as a whole.

Missouri DOT and the rest of the project team received reminders almost daily of the benefits of their work for the St. Louis region. The project team received commendatory e-mails and letters from area residents, noting the quick and high-quality completion of the project and the minimal impact on neighborhoods and communities. Many motorists e-mailed after trying a route that the team had recommended, expressing thanks for the assistance and the shorter commuting time.

Satisfying the Community

Surveys mailed in February 2008, 2009, and 2010 measured public opinion of the information outreach and of the project as a whole (Figure 1, this page). The survey targeted residents in more than two dozen zip codes along the project and in areas to the east and west. Each year's results showed improvement. The February 2010 survey, with a return rate of 15 percent, yielded positive results for all of the public information and outreach.

The results revealed that the majority of respondents were satisfied with

- How well they were kept informed (97.7 percent);
- The timeliness of the New I-64 information (97.6 percent);
- The communication of alternative travel options (90.3 percent);
- The traffic flow within the construction work zones (77.4 percent);
- The understandability and accuracy of the work zone signs (90.4 percent);
- The mobility around the St. Louis area during the closure (76.7 percent); and
- The strategy of closing I-64 for two years instead of taking six to eight years to complete the project with lane closures (95.1 percent).

In sum, residents were satisfied with Missouri DOT's handling of the New I-64 Project.

PHOTOS: MISSOURI DOT

The I-64–I-170 interchange before (*left*), and after (*right*), the New I-64 Project.

Innovative Financing for Rural Transportation

The Texas Experience with Pass-Through Tolling Agreements

KHALI R. PERSAD, PATRICIA FRANCO LAWHORN, AND C. MICHAEL WALTON

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Transportation funding in Texas is not keeping pace with a growing demand for infrastructure. Motor fuel taxes and vehicle registration fees, which generate revenue, have been static in Texas since 1993, yet vehicle miles traveled (VMT) on Texas roads have risen by more than 40 percent.

State Highway Fund revenues and expenditures per VMT have risen from approximately 2 cents per VMT in 1993 to approximately 3 cents (Figure 1, page 24)—mostly the result of bonds issued since 2002 (*1*). But with adjustments for construction inflation, the current expenditure equates to less than 1.5 cents per VMT in 1993 dollars. Transportation spending, therefore, has been falling behind needs in Texas.

According to U.S. Census figures, Texas is one of the fastest-growing states. During the past 25 years, the state's population increased by 57 percent, and road use increased by 95 percent—yet road capacity has grown by only 8 percent. Demographers estimate that in the next 25 years, the state population will increase by another 64 percent, road use will grow by 214 percent, and road capacity—without additional funding—will grow by approximately 6 percent (*2*).

Table 1 (page 24) shows roadway miles in Texas as of 2008 by functional classification and ownership, divided into urban and rural, in millions of VMT. Almost 70 percent of Texas road miles are rural and carry approximately 26 percent of VMT (*3*). In 2007, agriculture and oil and gas production—primarily rural activities—contributed approximately 8 percent to the gross state product of approximately $1.2 trillion (*1*).

According to the report of the Texas 2030 Committee, Texas must spend about $14 billion per year through 2030 to meet mobility and maintenance needs; the state currently spends around $6 billion per year (*4*). With transportation funding methods falling further behind demand, the Texas Department of Transportation (DOT) has encouraged tolling and other innovative financing mechanisms.

PHOTO: TEXAS TRANSPORTATION INSTITUTE

Monitoring highway traffic at a Texas DOT center; at the current rate of population growth in Texas, demand for road use may far outstrip road capacity in the next 25 years; capacity is projected to grow by 6 percent, but road use by more than 200 percent.

Innovations in Financing

Innovative transportation financing generally requires state and local partnerships, with private-sector participation where possible. Recent Texas legislation permits new kinds of partnering arrangements for developing transportation facilities. These new local entities include special-purpose transportation districts and corporations that can borrow and raise revenues, and Regional Mobility Authorities (RMAs), created by counties to construct and operate transportation projects, including tolls. RMAs can enter into agreements with private entities.

The private sector usually requires guarantees or risk-sharing agreements—or both—in partnering with the public sector to provide transportation infrastructure. A range of options is available for public support of private investment in transporta-

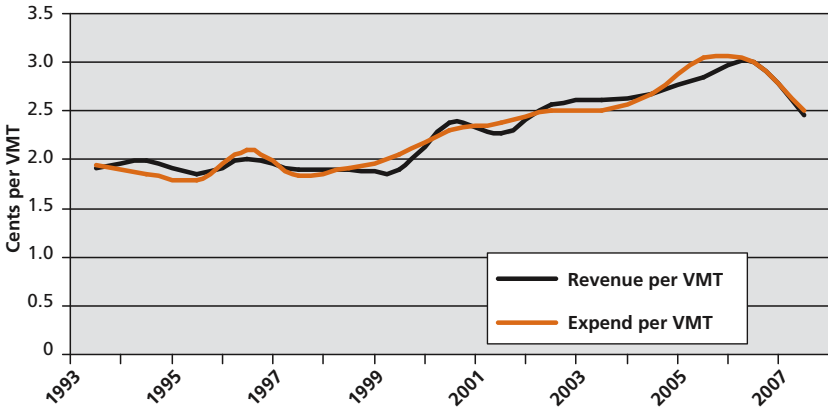

FIGURE 1 Texas State Highway Fund: revenues and expenditures per vehicle miles traveled (VMT), 1993–2007.

tion infrastructure, with varying degrees of risk exposure and ability to attract financing, as depicted in Figure 2 on page 25 (5). Four options appear to work well in balancing the government's exposure with the private sector's ability to raise financing: grants, subordinated loans, revenue guarantees, and shadow tolling, called pass-through tolling in Texas.

More than 45 alternative project-financing tools are available; Texas has applied 17 (6). An analysis of the tools indicates the importance of distinguishing up-front financing—a negative cash flow—from repayment—a positive cash flow. Up-front financing sources include grants, which do not require repayment, and debt, such as that incurred through bonds or loans. Sources of funds to repay debt include reimbursements, sale of assets, leases, fees, taxes, and tolls.

The varieties of up-front funding and repayment sources are summarized in Table 2 (page 26).[1] Any combination from the two categories of sources defines a potential project financing mechanism. Choosing a combination requires identifying and estimating the feasible repayment options to match the available up-front financing.

Shadow Tolling

With shadow tolling, the private sector finances the construction and maintenance of a facility and is repaid in installments by the government according to a formula based on the amount of traffic. The government pays the tolls on behalf of the users. For low-traffic scenarios, the formula may allow a high toll rate per VMT or a minimum monthly payment, with the rate dropping as traffic increases; in high-traffic scenarios, this may cap out at a minimum rate per VMT or a maximum monthly payment.

The World Bank championed shadow tolling in the 1970s and 1980s to stimulate private investment in public infrastructure. The most well-known applications are in Britain, where the first agreement was executed in 1997. The payment period was set at 30 years, in line with typical debt financing.

The British government maintained that the projects would facilitate greater private-sector efficiency and innovation. Some experts have criticized these arrangements, however, as "government-licensed monopolies, with powers akin to taxation, and as such an alienation of revenue streams from the public to the private sector" (7).

The government's primary benefit from shadow tolling is that a facility is built up front, and the costs

[1] Details are available in Texas DOT Research Report 0-6034-1, www.utexas.edu/research/ctr/pdf_reports/0_6034_1.pdf.

TABLE 1 Miles of Roadway in Texas by Ownership and VMT, 2008 (*3*)

Functional Classification	Texas DOT	Counties	Municipal	Other Jurisdictions	Federal	Total Miles	VMT (millions)
Urban Interstate	1,176	–	–	–	–	1,176	39,492
Urban: other freeways	1,435	21	26	107	–	1,589	29,901
Urban: other principal arterials	4,137	134	1,512	13	–	5,796	20,166
Urban: minor arterials	2,338	772	5,031	1	–	8,142	429
Urban collectors	4334	1,474	6,644	17	–	12,469	192
Urban local	228	10,269	53,735	–	–	64,232	2
Urban totals	**13,648**	**12,670**	**66,948**	**138**	**–**	**93,404**	**90,182**
Rural Interstate	2,058	–	–	–	–	2,058	15,397
Rural: other principal arterials	7,474	4	–	–	–	7,478	16,603
Rural: minor arterials	9,932	53	23	–	–	10,008	365
Rural: major collectors	33,095	1,309	64	5	84	34,557	118
Rural: minor collectors	13,611	4,532	175	0	47	18,365	1
Rural local	249	127,062	12,519	2	700	140,532	–
Rural totals	**66,419**	**132,960**	**12,781**	**7**	**831**	**212,998**	**32,484**
Totals	**80,067**	**145,630**	**79,729**	**145**	**831**	**306,402**	**122,666**

Photo: Kirk Tuck, Central Texas Regional Mobility Authority

User-paid tolls are one of the ways agencies can repay road construction debt; (*left:*) the Park Street toll plaza on Texas Toll 183A. In shadow or pass-through tolling, by contrast, the government repays the investment of a private contractor in installments on behalf of road users.

are stretched over many years. A drawback is that the total payments may exceed the actual cost. The public benefits from the facility sooner but may have to pay additional taxes or fees.

If the developer is a public entity, the expected benefit is economic development and revenue for future projects. If the developer is private, the expected benefit is a profitable return on investment. The developer takes a risk that the traffic may be less than projected, so that the reimbursements fall short of debt service and the project becomes a drain on finances.

Britain has completed at least eight shadow toll projects (*8*). With experience, changes have been made to the original shadow tolling arrangement (*9*)—for example,

- Capping the total payout, to avoid the perception of excessive private profits at taxpayer expense;
- Awarding performance bonuses to the operator, based on user feedback;
- Making deductions when a facility is not available to users or when use is restricted;
- Offering incentives for safety improvements that could reduce accident rates—such as 25 percent of the economic cost for each personal injury avoided; and
- Requiring a 10-year life expectancy for roadways handed back to the government—if the facility is in substandard condition at that time, charges may be levied on the operator.

With the success of shadow tolling in Britain, other European countries—such as Finland, Spain, and Portugal—have adopted it. The United States only recently has applied a similar type of transportation financing, and Texas has led the way with its own version, called pass-through tolling agreements (PTAs).

Pass-Through Tolling in Texas

With the slogan, "Open for Business," Texas DOT has encouraged partnerships to add capacity to its roadway system (*10*). According to Texas DOT, "in a pass-through financing agreement, the developer agrees to finance, construct, maintain and/or operate a project on the state highway system." Texas DOT "reimburses the developer *the cost of the project* [sic] rather than assessing a toll directly on users," and "makes periodic payments based on the number and types of vehicles using the facility" (*9*).

The Texas Mobility Fund (TMF) supports the Texas DOT PTA payments. In 2002, state Proposition 14 gave Texas DOT the authority to issue $3 billion of bonds to establish the TMF, with debt backed by the state's general obligation pledge, as well as by revenue from traffic fines and fees.

Project Criteria

A highway project is eligible for PTA funding in Texas (*11*) if it

FIGURE 2 Risk sharing and ability to raise financing under various public–private partnership arrangements (*5*).

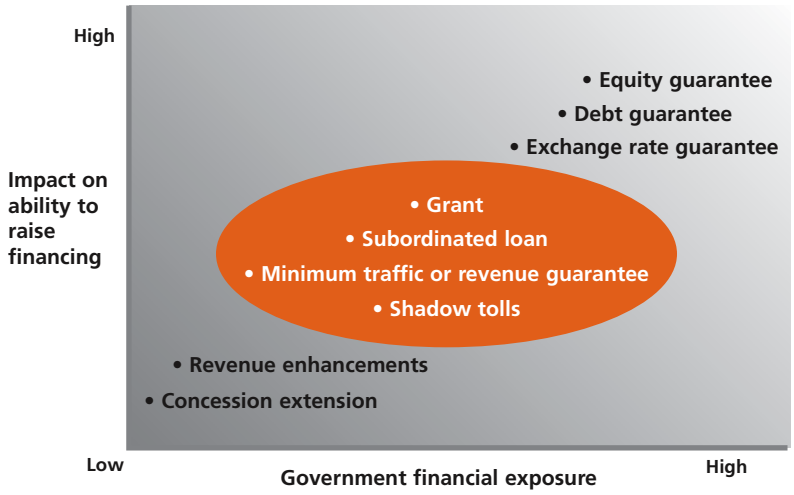

TABLE 2 Up-Front Financing and Repayment Sources

Financing Sources	Repayment Sources
Grants	**Reimbursements**
Federal grants	Pass-through (shadow) tolls
Community development block grants	**Sales and Leases**
Rural Safety Innovation Program	Sale of assets
Intelligent Transportation Systems Program	Leases and concessions
State grants	**Fees and Fines**
Texas toll equity	Traffic impact fee from developers
Local contributions	Property development fees
Private funds from landowners, developers, or businesses	Utility installation fee
Local government general funds	Transportation utility fee
Mix of public and private contributions	Transportation fees
Tapered matching on federal grants	Vehicle ownership fees
Transportation development credits	Road fees
Debt	Miscellaneous traffic fines
Bonds	**Taxes**
Tax-exempt bonds	*Property Taxes*
Tax credit bonds	Special tax districts
State Bonds	Tax increment financing
Texas Mobility Fund	*Sales Taxes*
Grant anticipation bonds	Dedicated sales tax
Local Bonds	Vehicle-related sales taxes
General obligation bonds	**Tolls**
Limited obligation bonds	Corridor tolling
Private Activity Bonds	Cordon tolling: requires viable public transportation alternatives
Loans	Freight tolling
Section 129 Loans	VMT or mileage tolling
TIFIA Loans	Congestion pricing
Secured (direct) loan	
Loan guarantee	
Line of credit	
State Infrastructure Bank	

PHOTO: WIKIMEDIA COMMONS

Tolling on a segment of Texas State Highway 99 started in 2010.

- Promises financial benefits to the state;
- Demonstrates support from the local public;
- Is part of Texas DOT's Unified Transportation Program;
- Offers congestion relief for the state highway system;
- Shows potential benefits to regional air quality; and
- Is compatible with current and planned transportation facilities.

In addition, the proposing entity must have experience in developing highway projects and the qualifications to complete the work. If the proposer is a public entity, it may designate a geographic area within its jurisdiction as a transportation reinvestment zone.

Basically, a project can qualify for a PTA if it is in the Unified Transportation Program and if public support can be demonstrated. The qualitative nature of the criteria has allowed a variety of projects to gain PTA funding.

PTA Projects

PTAs have been a popular financing tool in Texas—many counties and cities have petitioned the Texas DOT Commission for PTA projects. Between August 2005 and October 2007, Texas DOT authorized 13 PTAs for negotiation, in partnership with 10 different counties, two cities, and a private developer. Of the 13 projects, 4 failed to reach a contract. The data used here derive from the application and agreement documents for the 13 PTAs, supplemented by a questionnaire, interviews, and in-depth discussions with 23 agencies from Texas DOT districts and local governments.

All of the 9 PTAs that were executed use a fixed rate per VMT, regardless of the amount of traffic, but all have established a minimum and maximum monthly payment. The VMT rate varies among the agreements, with rural area projects receiving 15 cents per VMT; semiurban projects receiving from 10 cents, near San Antonio, to 14 cents, near Austin; and urban projects receiving 7 cents, as in Houston–Montgomery County.

The period of payments varies from 10 to 20 years. The lowest traffic scenarios result in payments that are stretched out over a longer period, and the highest traffic scenarios result in higher payouts initially, followed by lower amounts in later years. In most cases, Texas DOT participates in up-front financing in addition to the PTA payments; the agency's minimum PTA commitment is more than 90 percent of the up-front financing provided by the other partners.

Figure 3, page 27, shows the estimated Texas DOT commitments in PTAs approved as of October 2007 (*6*). Depending on the opening date of each facility, the traffic, and the resulting payout period, total commitments are estimated at approximately $1.32 billion.

In October 2007, the PTA program exhausted its funding, and additional PTAs were placed on hold. Legislation enacted in July 2009 granted Texas DOT the authority to issue another $2 billion in bonds backed by state general revenue, and the PTA funding resumed.

Findings

Four significant issues have arisen with the Texas PTA program (*6*):

1. *Project selection.*

The Texas DOT criteria for selecting PTA projects should be more rigorous. The criteria do not reflect lessons learned from shadow tolling in Europe—for example, that the technical characteristics of the project, its revenue potential, and the risks are key.

Criteria such as congestion relief and air quality improvements should be quantified. The decision to use PTA financing should relate to the objectives of the project. PTAs should be directed primarily to improving mobility—a statewide benefit—with local economic development a secondary goal.

2. *Risk sharing.*

PTA reimbursements should be tailored to the circumstances, with the risk shared in proportion to the expected benefits. Most of the PTAs guaranteed that the investors would recover most of the money they spend; in some cases, they also received the local revenue that was generated. Under this risk-free arrangement, the demand for PTA funding quickly outstripped availability. In contrast, British practice requires risk sharing, with many safeguards to reduce government exposure, including competition among investors and a cap on the total payout.

The Texas reimbursement rate per VMT appears inconsistent, with rural areas receiving 15 cents per VMT compared with 7 to 10 cents for urban areas. Gas taxes in Texas generate a revenue of less than 2 cents per VMT; paying 7 to 15 cents per VMT for road building therefore is exorbitant.

3. *Cost–benefit analysis.*

When public funds are involved, the benefits for each party should be properly estimated, and the costs and future revenues shared accordingly. Texas DOT includes economic development as part of its mission, yet revenues from sales taxes and local taxes are not contributed to transportation.

A cost–benefit analysis of PTAs should take into account the revenue streams from the project. No formal cost–benefit analysis, however, was performed for any of the PTAs, except for a qualitative review confirming benefit to the local economy. In two cases, preliminary toll feasibility estimates were performed; neither project proved toll-feasible.

4. *Negotiating agreements.*

Texas DOT district staff should receive guidance on negotiating innovative financing agreements. Traditionally, DOTs have accumulated revenue before funding the construction of facilities; as a result, staff never dealt with project financing. As DOTs enter into debt financing, staff need appropriate training. In some cases, for example, Texas DOT contributed project planning, design, and construction management services without counting the costs. In other cases, staff fast-tracked any project for which another party offered financing.

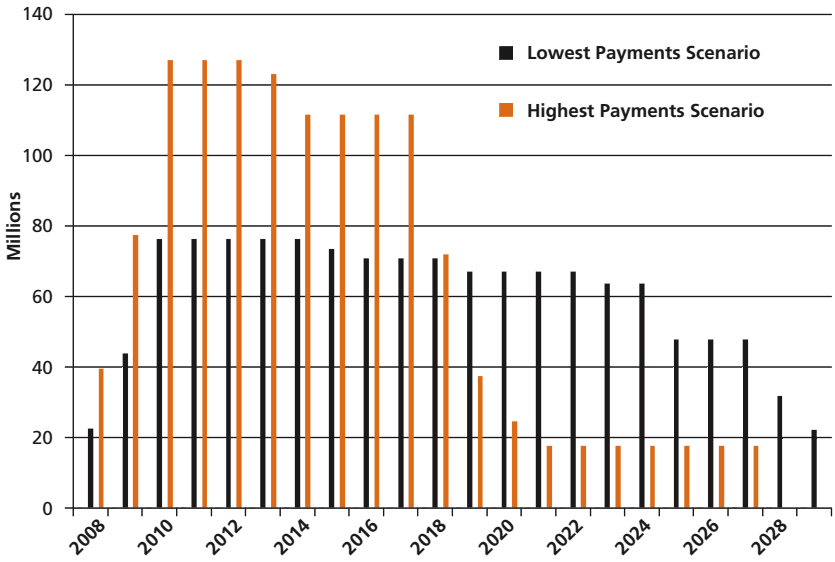

FIGURE 3 Texas DOT annual commitment amounts for pass-through toll agreements (*6*), assuming a project completion date 3 years from execution of agreement.

Lessons Learned

In addition to these findings, the interviews frequently raised six points about partnerships in general and PTAs in particular:

1. Explain the process. All parties involved in a partnership need to understand the transportation project development process and timelines. Some nontransportation professionals, for example, may expect that construction will start as soon as the funding is available.

2. Develop relationships. Good relationships with local government, chambers of commerce, and political leaders are important for leveraging funding and gaining public support—or for mitigating any opposition.

3. Clarify the details. After potential partners enter discussions, the details of the partnering arrangements need to be clarified as soon as possible. For example, under PTAs, Texas DOT could reimburse for no more than the amount paid up front by another party but could not reimburse for interest.

4. Set realistic schedules. Addressing environmental requirements can be time-consuming.

Photo: Kirk Tuck, Central Texas Regional Mobility Authority

An overpass on the 183A toll road at Brushy Creek in Williamson County, Texas. The toll-financed road opened in 2007 as the Central Texas Regional Mobility Authority's (RMA) first project; Texas RMAs can enter into agreements with private entities.

Although a key benefit of debt financing is getting projects built sooner, the parties cannot neglect the permitting process or the competing demands of other district projects.

5. Designate a leader and communicate. The responsibilities of each entity in a partnership must be clearly defined, including communication to all partners about critical updates. With regular meetings, the parties can discuss the project status, resolve any conflicts, and focus on action items.

6. Be flexible. The possibility of changes in the project's design and scope call for flexibility in the financial plan.

Improving the Practice

Texas has gained leading-edge experience with PTAs in the United States and with innovative financing arrangements for rural projects. PTAs are conceptually the same as shadow tolling, but the application in Texas differs somewhat from European models. A study of 13 PTA agreements in Texas revealed desirable improvements in four areas: project selection, risk sharing, cost–benefit analysis, and negotiating agreements.

Partnerships require the equitable sharing of project risks. Texas DOT needs to strengthen its procedures for selecting partnership projects and financing tools. Although Texas DOT includes economic development as a project goal, no formal procedure is in place for estimating or sharing economic benefits. Each party to an agreement expects to gain specific benefits, and an explicit estimate of these benefits is necessary for an equitable contract.

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Transportation, Livability, and Economic Development in a Changing World

1 At the Chairman's Luncheon, 2010 Executive Committee Chair Michael Morris (*center*) and member Beverly A. Scott (*lower right*) converse with TransTech Academy students from Cardozo Senior High School in Washington, D.C. For many years, TRB has assisted TransTech, which provides education and career experience to the next generation of transportation researchers. The meeting featured expanded outreach to new and young professionals.

2 Peng Liao (*right*) and Jun Chen (*left*), Southeast University, China, study the Annual Meeting program with Shunying Zhu, Wuhan University of Technology (*center*). International attendees brought research perspectives from more than 70 countries to the meeting.

3 The 2011 Annual Meeting set a record for attendance—nearly 11,000 participants converged in Washington, D.C., to network and to take part in approximately 650 sessions and workshops.

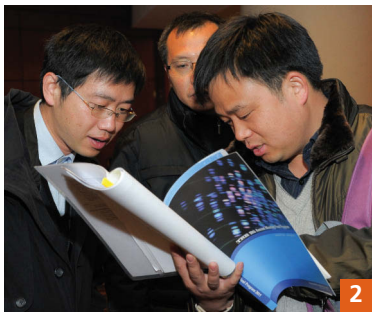
Annual Meeting photographs by Cable Risdon Photography

The Transportation Research Board's 90th Annual Meeting, January 23–27, 2011, in Washington, D.C., attracted a record attendance of nearly 11,000 transportation professionals, scholars, and policy makers from the United States and abroad. More than 85 sessions and workshops explored the theme of "Transportation, Livability, and Economic Development in a Changing World"; more than 4,000 presentations and 650 workshops and sessions—along with committee meetings, special events, and awards presentations—gave attendees opportunities to network and to share research findings.

This year's meeting had notable success attracting and encouraging students and young professionals. After a Welcome Session for Annual Meeting newcomers, approximately 600 young attendees volunteered to serve on TRB committees—a significant increase from the previous year. Slides and posters of the program presentations, a compendium of approximately 2,200 technical papers, and videos of more than 40 high-profile sessions were made available through a new TRB Annual Meeting Online feature.

Longtime railway industry leader James W. McClellan of the Woodside Consulting Group delivered the 2011 Thomas B. Deen Distinguished Lecture. Deborah A. P. Hersman, Chair of the National Transportation Safety Board, was the featured speaker at the Chairman's Luncheon, which included major award presentations.

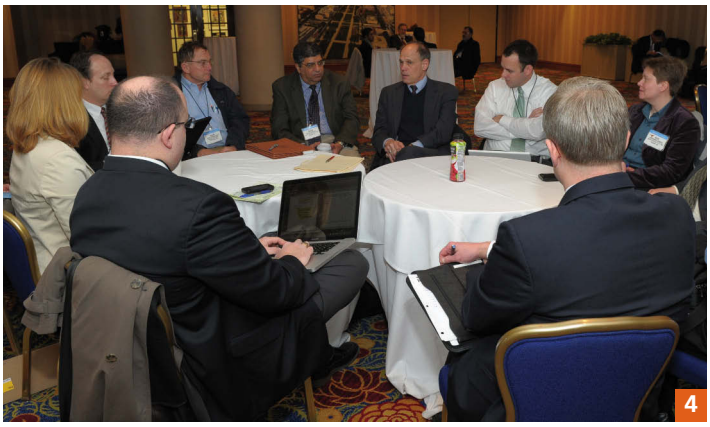
Details and highlights appear on the following pages.



INTERSECTIONS

1 Lori Diggins, LDA Consulting (*left*), confers with Meredith Howell, U.S. Department of Transportation (DOT), at the New and Young Attendees Welcome Session. The session provides an opportunity for attendees age 35 and under to become active in TRB committees.

2 Christopher Hart, National Transportation Safety Board (*left*), and Tony Fazio, Federal Aviation Administration, prepare to speak at a workshop on understanding industry safety culture, part of a special series of workshops focusing on human factors in transportation.



3 Liv Haselbach, Washington State University (*left*), poses with daughter Candace Brakewood, Massachusetts Institute of Technology, after Brakewood's presentation on transit rider research. Haselbach also presented papers at the meeting.

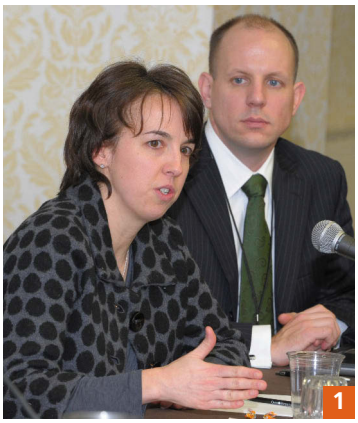
4 Networking opportunities at the Annual Meeting included informal gatherings, university and corporate receptions, and TRB and outside committee events.

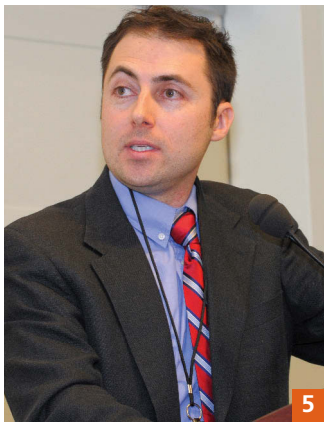
5 *(TRB's 2011–2012 Technical Activities Council, front row, left to right:)* Johanna Zmud, RAND Corporation; Steven Silkunas, Southeastern Pennsylvania Transportation Authority; Chair Katherine Turnbull, Texas Transportation Institute (TTI); Mark Norman, TRB; Jeannie Beckett, Beckett Group; *(back row, left to right:)* Mark Kross, consultant; Peter Mandle, LeighFisher, Inc.; Ronald Knipling, consultant; Peter Swan, Penn State; Thomas Kazmierowski, Ontario Ministry of Transportation; Edward Kussy, Nossaman LLP.

5 The Technical Activities Council oversees the organization and activities of TRB's standing committees.

6 At the Exhibit Hall, participants were able to browse displays from more than 150 businesses and organizations.

7 April Armstrong, Science Applications International Corporation (*left*), and Gary Millsaps, Delcan Corporation, explore the Second Strategic Highway Research Program (SHRP 2) display in the Exhibit Hall.





SPOTLIGHT SESSIONS

1 Lucille Marvin, U.S. DOT, explores Economic Development Strategies to Increase Freight Rail Mode Share.

2 Nikiforos Stamatiadis, University of Kentucky, leads a dialogue on Reinventing Project Management Practices to Integrate Context-Sensitive Solutions.

3 Atlanta, Georgia, Mayor Kasim Reed discusses his city's experience with the Transportation Investments Generating Economic Recovery Act of 2009.

4 David Congdon, Old Dominion Freight Line (*left*), examines energy and emission impacts of different vehicle configurations at a green trucking workshop.

5 At a session on the key elements of urbanism, Wesley Marshall, University of Colorado, Denver, presents research on the spatial distribution of vehicle miles traveled based on street network characteristics.

6 Derek Toups, Kimley-Horn and Associates, Inc., shares perspectives on evolving technologies for managed lanes.

7 Ruth Steiner, University of Florida, poses a question to panelists at a session on Transportation Systems for Livable Communities.

8 Trevor Hanson, University of New Brunswick (*right*), shares his paper on travel behavior of seniors in rural New Brunswick, Canada.

9 Panelists for Ecology of Scale: Road Ecology Research and Practice included (*left to right*) Krista Sherwood, National Park Service; Gail Achterman, Oregon DOT; Sandra Jacobson, U.S. Department of Agriculture; and Thomas Linkous, Westerville, Ohio.

SESSIONS AND WORKSHOPS

1 A recipient of the Dwight D. Eisenhower Transportation Fellowship, Laura Poff of Vanderbilt University presented her research on characterizing and implementing cyber-physical systems.

2 Kenneth Buckeye, Minnesota DOT (*right*), addresses the state perspective on active traffic management.

3 Stephen K. Robinson, National Aeronautics and Space Administration, draws on his experience as an astronaut in his address at the Human Factors luncheon.

4 Alexander Skabardonis, University of California, Berkeley, offers insights on Traffic Signal Control Strategies for Emission Reduction: The Case of IntelliDrive.

5 Susan Shaheen, University of California, Berkeley, leads a workshop on increasing ridesharing.

6 Anita Narh-Dometey of Morgan State University, one of four TRB Minority Student Fellows for 2010–11, describes her research on the Cumulative Impact of Developments on Surrounding-Roadway Traffic to Kwasi Donkor, Fehr & Peers.

7 Tom Scullion, TTI, explains Development of Infrared Photography and Ground-Penetrating Radar Procedures for Identifying Mixture Segregation at a poster session for high-value research projects from state DOTs.

8 Ann Dellinger, Centers for Disease Control and Prevention, speaks on traffic safety as a public health issue in a Human Factors workshop comparing traffic safety problems, research approaches, and countermeasures in different countries.

9 Eric Kerness, Kerness Consulting, explores Risk Management Considerations for Long-Term Public–Private Partnerships.

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10 Panelists for Current Freight Research and Implications for Freight Data included (*left to right*) moderator Scott Drumm, Port of Portland; Garreth Rempel, University of Manitoba, Canada; Donald Ludlow, Cambridge Systematics, Inc.; David Plazak, TRB; Alison Conway, City College of New York; and Johanna Zmud, RAND Corporation.


10

SESSIONS AND WORKSHOPS

(continued)

1 Genda Chen, Missouri University of Science and Technology, guides discussion on Lessons Learned from the 2010 Chile Earthquake.

2 Kathy Ruffalo, Ruffalo & Associates, examines the History and Future of the Highway Trust Fund.

3 Anand Puppala, University of Texas at Arlington, participates in a Dialogue with Leaders in Design and Construction of Transportation Facilities.

4 Along with a panel of experts from Canada, Belgium, the Netherlands, and the United States, Takayuki Oba of Japan's Ministry of Land, Infrastructure, and Transport (*right*), explores International Bilateral and Multilateral Intelligent Transportation System Research Activities.

5 Therese McMillan, Federal Transit Administration (FTA), presides over Strategies for Achieving a State of Good Repair.

6 Njoroge Wainaina, North Carolina DOT, introduces a speaker at a session on transportation design and construction.

7 Alan Blatt, CUBRC, Inc., shares experiences Implementing the SHRP 2 Naturalistic Driving Study.

8 Sulapha Peethamparan, Clarkson University, moderates a session on Behavior of Cementitiously Stabilized Soils.

9 Torkel Bjørnskau, Institute of Transport Economics, Norway, presents research on bicycle risk in Norway and Europe.

SESSIONS AND WORKSHOPS
(continued)

1 At a discussion with U.S. DOT leadership, administrators Joseph Szabo, Federal Railroad Administration (*left*), David Strickland, National Highway Traffic Safety Administration; and Peter Rogoff, FTA, consider the future of surface transportation authorization.

2 Orlando Gotay, U.S. Maritime Administration, shares his agency's priorities and progress at a session on Future Directions in Transportation.

3 William Bronrott, Federal Motor Carrier Safety Administration (FMCSA), participates in dialogue with fellow U.S. DOT deputy administrators.

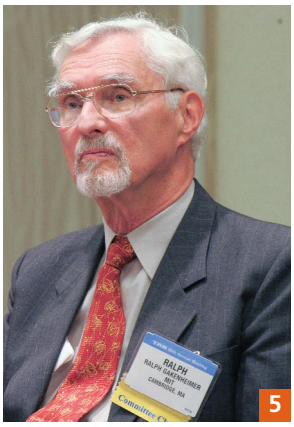
4 T. Peter Ruane, American Road and Transportation Builders Association (*left*); Hal Kassoff, Parsons Brinckerhoff; and Victor Mendez, FHWA, listen to research presented on Highways for LIFE.

5 At a session on Rural Road Safety, Keith Knapp, Iowa State University, points to newspaper coverage of the issue.

6 The Fourth Annual Competition on Communicating Concepts with John and Jane Q. Public presented awards for fresh and creative methods to convey technical transportation messages to the community.

7 Panelists (*left to right*) William M. Sampson, University of Florida; F. Thomas Creasey, Entran; Kenneth G. Courage, University of Florida; Roger P. Roess, Polytechnic Institute of New York University; Richard G. Dowling, Dowling & Associates, Inc.; Lily Elefteriadou, University of Florida; and James A, Bonneson, TTI, present the recently published *Highway Capacity Manual 2010*.

6 (*Above*) Katherine Turnbull, TTI and Chair of the TRB Planning and Environment Group (*left*); communications competition winner Randall Blankenhorn, Chicago Metropolitan Agency for Planning (CMAP); and Jennifer Weeks, Parsons Brinckerhoff and Chair of the Public Involvement in Transportation Committee. CMAP's entry was "Invent the Future," a multimedia public outreach campaign to help guide the direction of future planning initiatives.



COMMITTEE MEETINGS

1 Anita Vandervalk-Ostrander, Cambridge Systematics (*left*), presents information on traffic management to the Statewide Transportation Data and Information Systems Committee.

2 Patricia Hu, then with Oak Ridge National Laboratory, speaks at a program for students and new transportation professionals hosted by the Traffic Flow Theory and Characteristics Committee. Hu is now Director, Bureau of Transportation Statistics.

3 Conrad Felice, C. W. Felice, LLC, leads a meeting of the Modeling for the Design, Construction, and Management of Geosystems Committee.

4 Chair Kathryn Zimmerman guides the Transportation Asset Management Committee through its meeting agenda.

5 Ralph Gakenheimer, Massachusetts Institute of Technology, chairs the Transportation in the Developing Countries Committee.

6 Andrew Tarko reviews current activities and explores future directions of the Surrogate Measures for Crash Data Sub-committee.

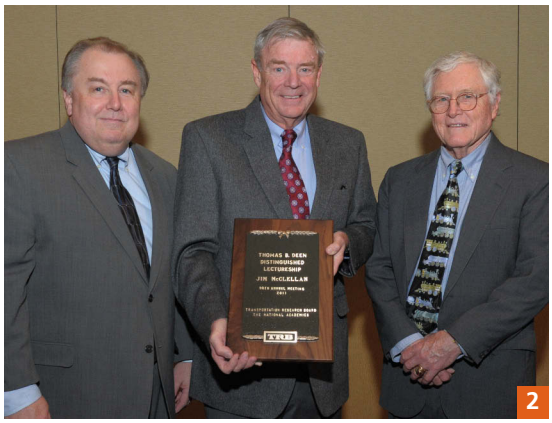
7 Wei Shen, IBM Watson Research Center (*left*), delivers a presentation to the Regional Transportation Systems Management and Operations Committee.

8 D. Stephen Lane, Virginia Center for Transportation Innovation and Research (*left*), presents a certificate of appreciation to Nancy Whiting, Purdue University, outgoing chair of the Mineral Aggregates Committee.

9 Rita B. Leahy, Asphalt Pavement Association of California (*left*), receives commendation from Stuart D. Anderson, Texas A&M University, for her years of service as chair of the Management of Quality Assurance Committee.

DEEN LECTURE AND PAPER AWARDS

1 James W. McClellan, Woodside Consulting Group, delivers the 2011 Thomas B. Deen Distinguished Lecture.



2 2010 Executive Committee Chair Michael R. Morris, North Central Texas Council of Governments (*left*), and former TRB Executive Director Thomas B. Deen (*right*) present McClellan (*center*) with the Deen Lectureship plaque.

3 Technical Activities Council Chair Robert C. Johns, Volpe Transportation Center, introduces winners of the Awards for Outstanding Papers.

4 Johns (*left*) presents the Pyke Johnson Award to Helmut Knee (*center*) and Oscar Franzese of Oak Ridge National Laboratory. Not present was coauthor Lee Slezak, U.S. Department of Energy.

5 The Charley V. Wootan Award winners for outstanding paper in policy and organization were Jiang Hao (*left*) and Eric Miller, University of Toronto, and Marianne Hatzopoulou, McGill University.

6 Athar Saeed, Applied Research Associates, Inc. (*left*), and Michael Hammons, U.S. Air Force Research Lab, received the K. B. Woods Award for outstanding paper in design and construction.

7 Nagui Rouphail (*left*) and Bastian Schroeder, North Carolina State University Institute for Transportation Research and Education, were recipients of the D. Grant Mickle Award.

8 Richard Christopher, HDR Engineering, received the John C. Vance Award for his work as editor of *The Natural Lawyer*.

9 The Fred Burggraf Award for outstanding paper in planning and environment by authors under age 35 was presented to James Fox, RAND Europe (*left*), and Stephane Hess, University of Leeds.

10 Yu Zhang (*left*) and Nagesh Nayak of the University of South Florida won the Burggraf Award for outstanding paper in aviation by young researchers.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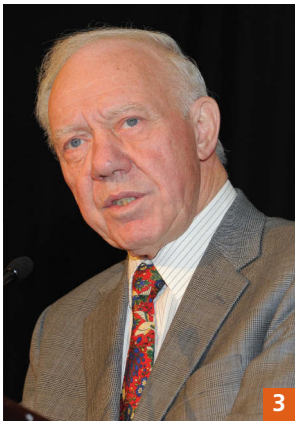
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CHAIRMAN'S LUNCHEON AND AWARDS

1 In her address, National Transportation Safety Board Chairman Deborah A. P. Hersman stressed the importance of investment in safety and of accurate, accessible records. She recounted cross-modal lessons learned in high-profile events such as the 2007 I-35W bridge collapse in Minnesota; the 2009 Washington, D.C., Metro crash; and the 2010 pipe explosion in San Bruno, California.

2 TRB Executive Director Robert E. Skinner, Jr., presents the Frank Turner Medal for Lifetime Achievement in Transportation to Jane Garvey, Meridiam North America.

3 Former U.S. Congressman James L. Oberstar (D-Minnesota) received the George S. Bartlett Award for outstanding contributions to highway progress.

4 2011 Executive Committee Chair Neil Pedersen (*right*) presents the W. N. Carey, Jr., Distinguished Service Award to Kansas DOT Secretary and former Executive Committee Chair Debra L. Miller.

5 2010 Executive Committee Chair Michael R. Morris (*right*) congratulates Roy W. Crum Award winner A. Keith Turner, emeritus professor, Colorado School of Mines.

6 Charles Vest, President, National Academy of Engineering, delivers introductory remarks at the Chairman's Luncheon.

Committees Salute Long-Term Leaders

In recognition of their important long-term contributions and outstanding service on technical activities committees, 11 individuals were awarded emeritus membership at the 2011 Annual Meeting. The honorees and their committees are

- **Jon E. Burkhardt**, Rural Public and Intercity Bus Transportation Committee;
- **Jerry M. Faris**, Transportation Planning Applications Committee;
- **Frank Fee**, General Issues in Asphalt Technology Committee;
- **Linda K. Howard**, Aviation System Planning Committee;
- **Katharine M. Hunter-Zaworski**, Accessible Transportation and Mobility Committee;
- **Ramankutty Kannankutty**, Construction of Bridges and Structures Committee;
- **Douglas B. Lee, Jr.**, Transportation Economics Committee;
- **Sue McNeil**, Transportation Asset Management Committee;
- **Christopher G. B. Mitchell**, Accessible Transportation and Mobility Committee;

Lalita Sen, Texas Southern University (*left*), and Russell Thatcher, TranSystems Corporation (*right*), cochairs of the Accessible Transportation and Mobility Committee, present an Emeritus Membership certificate to Katharine Hunter-Zaworski (*center*), Oregon State University.

- **William H. Moorhead**, Rail Transit Infrastructure Committee; and
- **Reynaldo Roque**, Characteristics of Asphalt Paving Mixtures to Meet Structural Requirements Committee.

New Leaders Step Up to Executive Committee

Neil J. Pedersen, Administrator, Maryland State Highway Administration (SHA), is the 2011 Chair of the TRB Executive Committee. He succeeds Michael R. Morris, Director of Transportation, North Central Texas Council of Governments. Sandra Rosenbloom, Professor of Planning, University of Arizona, is the 2011 Vice Chair.

2010 Executive Committee Chair Michael R. Morris (*right*) passes the gavel to 2011 Chair Neil J. Pedersen at the Chairman's Luncheon.

In 2003, Pedersen became Maryland SHA Administrator; he has overseen projects such as the Woodrow Wilson Bridge in metropolitan Washington, D.C., as well as the recently opened Intercounty Connector in Maryland, which links I-270 with I-95 north of the Capital Beltway. Before serving as Administrator, Pedersen was Director of the Office of Planning and Preliminary Engineering and Deputy Administrator and Chief Engineer for Planning and Engineering at SHA.

Pedersen, a Massachusetts native, has a TRB service record of more than 30 years. He currently leads the second Strategic Highway Research Program Technical Coordinating Committee for Capacity Research. From 2005 to 2008, he chaired the Technical Activities Council, has served on many TRB committees and panels, and is an emeritus member of the Statewide Multimodal Transportation Planning Committee. Also active with the American Association of State Highway and Transportation Officials, Pedersen chairs the Executive Board of the I-95 Corridor Coalition, a group of transportation agencies from 16 states, the District of Columbia, and two Canadian provinces. In 2006, he received the George S. Bartlett Award for his work promoting highway innovation.

Since 1990, Rosenbloom has been on the faculty of the University of Arizona, Tucson, where she served for more than 13 years as Director of the Roy P. Drachman Institute for Land and Regional Development Studies. She is an active participant in TRB committees and was the 2004 recipient of TRB's Roy W. Crum Award. Rosenbloom has written extensively on transportation planning and on societal trends in transportation and community development; in 1999, she received the Roger Tate Award for Outstanding Contributions to Accessible Transportation Research. She received a master's degree in public administration and a Ph.D. in political science from the University of California, Los Angeles (UCLA).

Newly appointed to the Executive Committee are James M. Crites, Dallas–Fort Worth International Airport; Michael W. Hancock, Kentucky Transportation Cabinet; Michael P. Lewis, Rhode Island Department of Transportation (DOT); Lawrence A. Selzer, The Conservation Fund; Kumares C. Sinha, Purdue University; and Thomas K. Sorel, Minnesota DOT. Reappointed to the Executive Committee are Deborah H. Butler, Norfolk Southern Corporation; William A. V. Clark, UCLA; and Susan Martinovich, Nevada DOT.

CELEBRATING TRB'S 90TH—Current and past Executive Committee chairs gather to commemorate 90 years of TRB: (*Front row, left to right:*) William Millar, American Public Transportation Association (1992); Genevieve Giuliano, University of Southern California (2003); former Executive Director Thomas B. Deen; Executive Director Robert E. Skinner, Jr.; Debra Miller, Kansas DOT (2008); Martin Wachs, RAND Corporation (2000); Joseph M. Sussman, Massachusetts Institute of Technology (1994); (*back row, left to right:*) Neil J. Pedersen, Maryland SHA (2011); Herbert H. Richardson, TTI (1988); Michael R. Morris, North Central Texas Council of Governments (2010); C. Michael Walton, University of Texas at Austin (1991); E. Dean Carlson (2002); and David N. Wormley (1997).

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EXECUTIVE COMMITTEE

1 2010 Executive Committee Chair Michael R. Morris guides committee members through a discussion of TRB business.

2 Executive Director Robert E. Skinner, Jr., reviews current TRB initiatives and programs.

3 Neil Pedersen, 2010 Vice Chair, offers insights.

Also participating in Executive Committee deliberations were

4 Sandra Rosenbloom, University of Arizona, 2011 Vice Chair;

5 Kumares Sinha, Purdue University;

6 Paula Hammond, Washington State DOT;

7 Eugene A. Conti, Jr., North Carolina DOT;

8 John T. Gray, Association of American Railroads (*right*), and Marc Carrel, South Coast Air Quality Management District;

9 Susan Martinovich, Nevada DOT;

10 James Crites, Dallas–Fort Worth International Airport (*right*), and Douglas Stotlar, Con-way Inc.;

11 Deborah Butler, Norfolk Southern;

12 Peter Appel, Research and Innovative Technology Administration;

13 Beverly Scott, Metropolitan Area Rapid Transit Authority; and

14 Daniel Sperling, University of California, Davis.

EXECUTIVE COMMITTEE

(continued)

Members of the TRB Executive Committee shared reports on endeavors, issues, and trends in transportation research. Participating in the conversation were

1 John Horsley, American Association of State Highway and Transportation Officials;

2 Kirk Steudle, Michigan DOT;

3 Anne Ferro, FMCSA;

4 David Seltzer, Mercator Advisors;

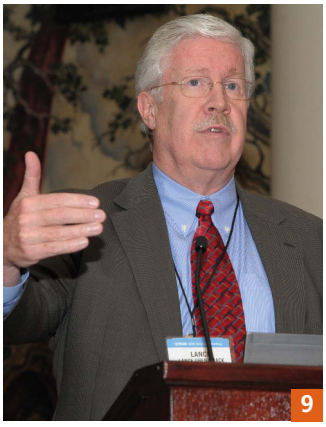
5 TRB Marine Group chair Jeannie Beckett, Beckett Group;

6 Arthur Guzzetti, American Public Transportation Association;

7 Jeffrey Paniati, FHWA; and

8 Vincent Valdes, FTA.

9 Lance Grenzeback, Cambridge Systematics, Inc., examines corridor-level priorities related to goods movement at the Executive Committee policy session.



10 Genevieve Giuliano, University of Southern California, answers questions about funding strategies and institutional issues during the national freight policy discussion.

11 Chelsea (Chip) White, Georgia Institute of Technology, presents a perspective on high-cost freight industry trends and their effect on a national freight policy.

12 Walter Kemmsies, Moffatt & Nichol, outlines trends in the bulk freight industry and examines issues to be addressed in a national freight policy.

13 Director of the University of Virginia's Miller Center of Public Affairs and former Virginia Governor Gerald Baliles (*left*) and Jeffrey Shane, Hogan Lovells, brief the Executive Committee on a report from the Miller Center's David R. Goode National Transportation Policy Conference in 2009.

NEW TRB SPECIAL REPORT

Federal Funding of Transportation Improvements in BRAC Cases

EDWARD WEINER AND STEPHEN R. GODWIN

Weiner, a transportation consultant in Silver Spring, Maryland, served as staff to the committee for this study. Godwin is TRB Director, Studies and Special Programs.

The Defense Base Closure and Realignment Commission (BRAC) is designed to provide an apolitical process for the timely closure and realignment of military installations in the United States. Previous decisions under the law primarily closed bases, but BRAC 2005 has increased the number of on-base personnel, military families, and defense-related contractors at or near 18 military bases, several in major metropolitan areas with traffic problems.

According to the findings of a study published by the Transportation Research Board (TRB) as Special Report 302, *Federal Funding of Transportation Improvements in BRAC Cases*, the time period for fully implementing the BRAC decisions—by September 2011—is too short to avoid significant additional traffic congestion for military personnel and other commuters during peak travel periods. A Congressional amendment to the Fiscal Year 2010 defense appropriations requested the study, and the National Research Council of the National Academies appointed the study committee under the auspices of TRB (see box, page 44).

The committee recommends that just as private developers must pay impact fees for improvements to access their sites, the U.S. Department of Defense (DoD) should accept more financial responsibility for resolving transportation problems related to growth on military bases in metropolitan areas. Similarly, communities that benefit economically from the presence of military bases should pay their share of the needed transportation improvements.

Issue

BRAC 2005 concentrates tens of thousands of additional personnel at several bases, some in metropolitan areas with transportation infrastructure that is already congested. The law stipulates that the BRAC realignments must be completed by September 15, 2011; because personnel will arrive as soon as the bases are readied, community changes will be rapid.

In limited circumstances, the criteria of the Defense Access Roads (DAR) program apply, and DoD provides funding for roadway improvements. For the most part, however, DoD considers state and

PHOTO: ANTHONY SANCHELLI, U.S. AIR FORCE

The Defense Base Closure and Realignment Commission (BRAC) increased the number of military personnel, families, and contractors on 18 bases; many are returning from overseas assignments. In metropolitan areas, the impacts on transportation systems may be severe, and sources of funding for expansion and upgrades are yet to be identified.

PHOTO: VIRGINIA DOT

Improvements to roads in southern Fairfax County, Virginia, have been under way to add capacity for the nearly 20,000 military and civilian personnel scheduled to arrive at Fort Belvoir under the base realignment plan.

local authorities responsible for addressing the increases in traffic attributable to military expansion.

Challenges

In BRAC cases, state and local jurisdictions must cope with the following challenges:

- The rapid pace of traffic growth on heavily used facilities, particularly in urbanized areas with limited options for expansion;
- The lengthy process for evaluating the environmental impact of projects and for including them in state and regional transportation plans;
- The intense competition among state and local projects for available federal and state aid for capacity enhancements; and
- The general shortage of available state and local funds.

Moreover, the normal length of time for developing highway and transit projects—from the planning and environmental processes through construction—is 9 years at best, and usually 15 to 20 years.

DoD has a limited view of its responsibilities for off-base transportation facilities. The only DoD program that can assist in funding transportation infrastructure off the base—the DAR program—is inadequate for base expansion in built-up areas. Eligibility for the program is determined by several criteria, including the doubling of traffic—which is impossible for metropolitan area facilities that already are congested.

Otherwise, under DoD policy, local and state authorities are responsible for off-base transportation facilities, even if DoD decisions increase congestion; this policy, however, is unrealistic for congested metropolitan transportation networks. In addition, off-base projects compete poorly in the military construction budget, which also funds the higher priorities of base commanders for on-base facilities. Finally, DAR is limited to road projects, yet transit expansion is often necessary to serve some travel demand in congested metropolitan areas.

Fort Belvoir is located south of a busy highway interchange in the metropolitan Washington, D.C., area. Overcrowded roads and a lack of transit options lead to a problematic traffic outlook under the BRAC consolidations.

Recommendations

The committee's recommendations to ameliorate the specific problems caused by BRAC 2005 during the next few years include the following:

- DoD should accept more financial responsibility for the traffic problems that it causes;
- The DAR program should adopt an impact fee approach in metropolitan areas affected by base expansion instead of providing funds only if traffic doubles;
- DoD should fund transit services needed for bases in metropolitan areas;
- Communities that benefit economically from the military should pay their share;
- The military and affected communities should improve communication, coordination, and planning for infrastructure projects, working though the ongoing urban transportation planning process carried out by metropolitan planning organizations; and
- Congress should consider a special appropriation or a reallocation of stimulus funds to pay for near-term improvements in the communities most severely affected by BRAC 2005.

Case Studies

The committee developed case studies of six bases for which BRAC 2005 decisions and other military actions are affecting or will affect traffic congestion significantly in the surrounding communities. The committee selected the cases for their diverse circumstances, the projected impact on civil transportation networks, and the gaps in funding to address the problems.

The case studies made clear that the BRAC consolidations, other sources of military growth at the

bases, and personnel returning from two wars are causing severe transportation problems. These problems will play out in many areas in the next few years.

Although the committee cannot predict the consequences, congestion could be sufficiently severe to affect the military and surrounding communities negatively by preventing personnel from reaching work within acceptable commute times. In contrast, one case study implied that in smaller jurisdictions with land available, transportation improvement plans are less controversial, and individuals on the military and civilian sides have worked together to anticipate and address capacity problems.

Fort Belvoir

Fort Belvoir is a single base that includes three noncontiguous geographic areas in Northern Virginia. Already the single largest employer in Fairfax County, Fort Belvoir will house more workers than the Pentagon after the BRAC consolidations.

According to the case study, many thousands of military and civilian employees are being moved from employment areas near the center of the region, served by well-developed highway and transit networks, to more remote locations in which competitive transit service is virtually impossible to achieve; moreover, most employees travel in single-occupant cars. Transportation facilities serving the Fort Belvoir area already are overloaded and are experiencing severe congestion.

National Naval Medical Center

The National Naval Medical Center (NNMC) in Bethesda, Maryland, is located in a densely populated, unincorporated area of Montgomery County. The center houses approximately 70,000 workers during the day, including 18,000 at the adjacent National Institutes of Health (NIH).

According to the report, the consequences for the saturated roads serving NNMC and other commuters could be severe. Increasing the throughput of the major arteries serving NNMC by adding lanes is out of the question because of cost and environmental impact, but even improving all critical intersections with additional turn-lane capacity is unfunded.

Also unfunded is an enhancement to the nearby Metrorail station that would deflect thousands of new transit users from crossing a major artery serving NIH and NNMC and causing additional delays. Overly ambitious plans for mode shifts are unlikely to work as well as intended.

Fort Meade

Fort Meade is located in Anne Arundel County, approximately equidistant between Baltimore, Maryland, and Washington, D.C. More than 40,000 military and civilian employees and private contractors work at the site, which contributes $4 billion annually to the Maryland economy.

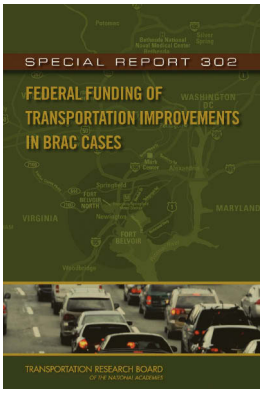
At Fort Meade, significant numbers of office workers are being moved from locations near the center of the region, which offers comparatively good transit service, to more remote locations with less extensive and rarely used transit service. The majority of workers will rely on private cars, clogging roads already strained under commuter traffic.

Planners have identified road improvements to alleviate some of these problems, but these remain mostly unfunded. Planners also project aggressive demand management programs—although these are important to the congestion management strategy, the goals are difficult to achieve because of Fort Meade's location.

Joint Base Lewis–McChord

Joint Base Lewis–McChord (JBLM) is located near South Puget Sound in Washington State and supports a population of more than 130,000 on base and in neighboring communities, including military personnel, families, and civilian and contract employees. The highway network serving the base depends heavily on Interstate 5 and operates at capacity. Expanding I-5 in the base corridor would cost an estimated $1 billion, but funding is not available.

Demand management measures are already in use for the civilian workforce at JBLM—carpooling, for example, is common—but these measures are less likely to be practical for the soldiers on an operating base of such size and complexity. JBLM



Special Report 302, *Federal Funding of Transportation Improvements in BRAC Cases*, is available from the TRB Bookstore at www.trb.org/Finance/Public/Bookstore.aspx; to view the book online, go to http://onlinepubs.trb.org/onlinepubs/sr/sr302.pdf.

Photo: Washington State DOT

Interstate 5, serving Joint Base Lewis–McChord in Washington State, is at capacity and often experiences traffic problems, but the estimated $1 billion needed for expansion is not available.

Photo: Cherie Cullen, Department of Defense

U.S. Secretary of Defense Robert M. Gates (*center*) tours new barracks under construction in 2008 at Fort Bliss, Texas, which has added 2,000 to 3,000 soldiers per year since 2006. The base, community, and state have worked together to implement trans - portation solutions.

depends almost totally on I-5, which is experiencing increases in stop-and-go operations, compounding delays and safety problems with backups and the loss of lane capacity.

Eglin Air Force Base

Eglin Air Force Base (AFB), located in Okaloosa County, Florida, is the largest AFB in the world, with approximately 16,500 military personnel and 4,500 civilian workers. The base expansion will significantly congest the only north–south state road in Okaloosa County, SR-85, and may disrupt travel on an east–west U.S. route that is important to the area's tourist economy.

The base is vital to the region, and the expansion will increase its importance. The state's concurrency law, however, limits development when infrastructure service levels decline below an acceptable standard. This will impede economic development until the highway is improved, and funding for improvements has not been secured. This could be harmful to the military's mission, because additional off-base housing and new business development to support base expansion cannot be approved until SR-85 is expanded.

Fort Bliss

Fort Bliss in northeast El Paso, Texas, is the fastest-growing U.S. Army installation in the United States. The base has added 2,000 to 3,000 soldiers annually since 2006, for a 2009 total of roughly 19,000 soldiers, 29,000 dependents, 3,000 civilian workers, and 2,000 private contractors.

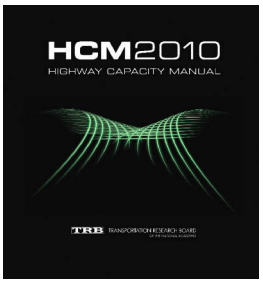
Although transportation improvements are needed in and around El Paso, Fort Bliss provides a counterexample to the other cases examined. A significant new segment of highway needed to support base expansion was identified early in the BRAC 2005 process, and the state and community found a way to fund the project, complete environmental reviews, and begin construction before all of the new soldiers and dependents arrive in 2012.

Completion of the project is expected in winter 2011. The case shows how base growth can be accommodated when a community and state are committed to support the project, and land is available for capacity expansion.

Communication and Planning

Resolving metropolitan area transportation congestion problems is complex and expensive. The additional travel demand caused by BRAC 2005 on congested routes serving bases cannot be accommodated in a few months or a few years. Over time, delays can be eased, but greater DoD funding, realigned metropolitan area priorities, and better communication between base commanders and civilian authorities will be required. Adoption of the committee's recommendations to improve base–community communication and planning will help avoid future problems caused by rapid growth in personnel at military bases.

NEW TRB PUBLICATION



Highway Capacity Manual 2010

PAUL RYUS, MARK VANDEHEY, LILY ELEFTERIADOU, RICHARD G. DOWLING, AND BARBARA K. OSTROM

Ryus is Associate Engineer, Kittelson & Associates, Inc., Svendborg, Denmark; Vandehey is Managing Principal, Kittelson & Associates, Inc., Portland, Oregon; Elefteriadou is Professor of Civil Engineering and Director of the Transportation Research Center, University of Florida, Gainesville; Dowling is President, Dowling Associates, Inc., Oakland, California; and Ostrom is Principal Engineer, MACTEC Engineering and Consulting, Beltsville, Maryland.

The fifth edition of the *Highway Capacity Manual* (HCM 2010), recently released by the Transportation Research Board (TRB), incorporates results from more than $5 million of research completed since the publication of the HCM 2000. This latest edition significantly updates the methodologies that engineers and planners use to assess the traffic and environmental effects of highway projects.

HCM 2010 introduces several firsts, including

- An **integrated multimodal approach** to the analysis and evaluation of urban streets from the points of view of automobile drivers, transit passengers, bicyclists, and pedestrians;
- Guidance on the proper **application of microsimulation analysis** and the evaluation of those results;
- The presentation of **active traffic management** in relation to demand and capacity; and
- **Generalized service volume tables** to assist planners in sizing roadway facilities.

Key Changes

Following are some of the key changes in the HCM 2010:

- The **signalized intersections** procedure models the operation of an actuated controller. A new incremental queue accumulation (IQA) method calculates the delay term d_1 and the length term Q_1. Although equivalent to the HCM 2000 method for the idealized case, the IQA method is more flexible and can accommodate nonideal cases, such as coordinated arrivals and multiple green periods with differing saturation flow rates, which can occur with protected-plus-permitted left turns. A check procedure for left-turn lane overflow also has been added.

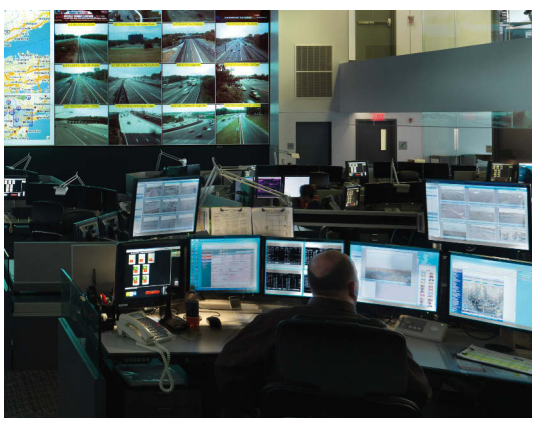


PHOTO: NEW JERSEY TURNPIKE AUTHORITY

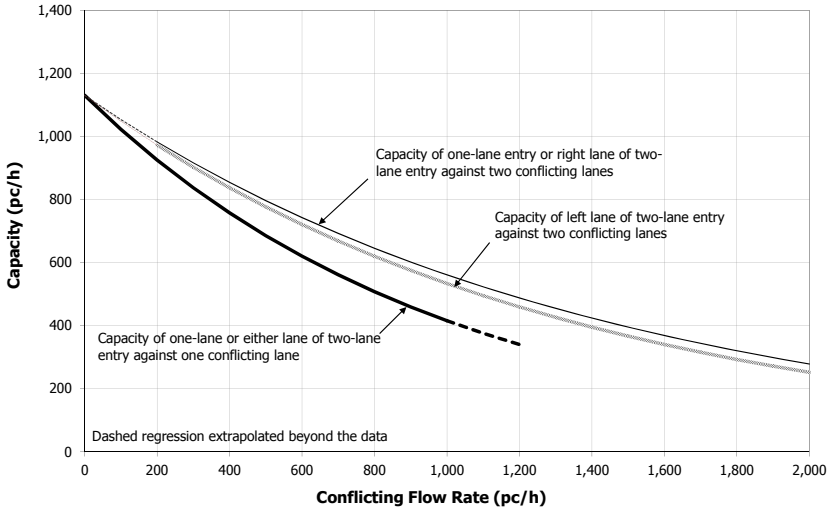
HCM 2010 features findings on active traffic management, which strategically deploys an array of measures to relieve congestion.

PHOTO: MINNESOTA DOT

Among the new features of HCM 2010 is updated material on the impact of weather and work zones on freeway capacity.

- **Unsignalized intersections**, previously a single chapter, now are described in three chapters, covering two-way STOP-controlled (TWSC) intersections, all-way STOP-controlled (AWSC) intersections, and roundabouts. The TWSC method in the HCM 2010 can analyze intersections along six-lane streets, and the AWSC method now includes a queue-estimation procedure. The roundabout material is completely updated, based on the work of National Cooperative Highway Research Program (NCHRP) Project 3-65,[1] which developed a comprehensive database of U.S. roundabout operations and established new methodologies for evaluating roundabout performance. The chapter adds a level-of-service (LOS) table for roundabouts.
- The **interchange ramp terminals** chapter has

[1] For titles of the NCHRP projects cited in this article, see the sidebar on page 48.



Capacity of roundabout entries, from Chapter 21; the roundabout material in HCM 2010 is completely updated and includes new methodologies for evaluating performance.

been completely updated with findings from the work of NCHRP Projects 3-60 and 3-60A. The chapter describes a new method for conducting operational analyses and obtaining the LOS for a full range of service interchange types—diamond, partial cloverleaf, and the single-point urban interchange. The chapter includes a methodology for assessing the operational performance of various types of interchanges and making an appropriate selection.

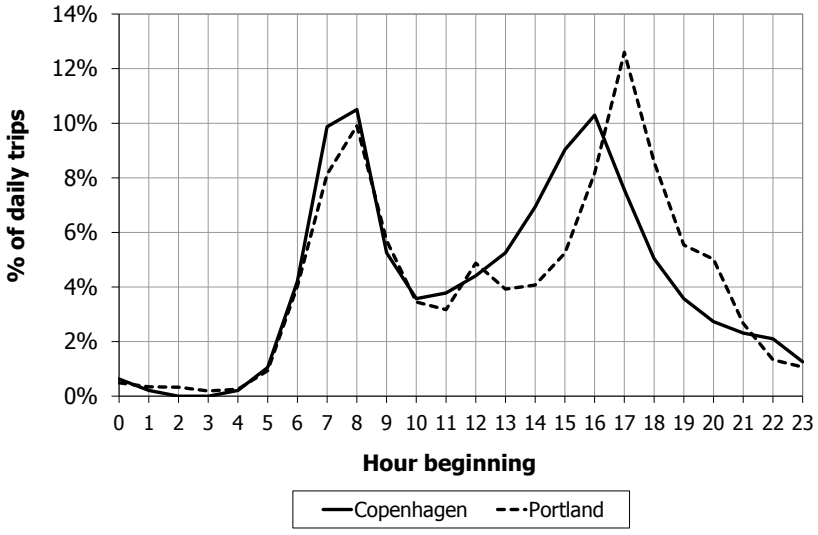
◆ The **urban street segments** chapter has been rewritten, incorporating the work of NCHRP Project 3-79. The chapter presents improved methods for estimating urban street free-flow speeds and running times, as well as a new method for estimating the stop rate along an urban street. In addition, NCHRP Project 3-70 has provided a methodology for evaluating tradeoffs in allocating urban street right-of-way among the modes.

◆ A new **urban street facilities** chapter traces out a methodology for aggregating results from the segment and point levels of analysis into a facility assessment. Information is provided on the impact of active traffic management measures on urban street performance.

◆ The **freeway facilities** chapter introduces a table for LOS based on density. Other updates include material on the impact of weather and work zones on freeway facility capacity, plus new information on the impact of active traffic management measures on freeway operations.

◆ The **freeway weaving** chapter has been completely updated with findings from NCHRP Project 3-75. Although the general process for analyzing weaving segments is similar to that given in HCM 2000, the HCM 2010 models derive from an up-to-date set of weaving data. The two major differences in applying the methodology are (*a*) a single algorithm for predicting weaving speeds and a single algorithm for predicting nonweaving speeds, regardless of the weaving configuration, and (*b*) the threshold for LOS F has changed.

Hourly variations in bicycle volumes for two cities that have invested in infrastructure and programs: Copenhagen, Denmark, and Portland, Oregon; from HCM 2010, Chapter 3.



New Approaches

A new chapter on **active traffic management**, based on research produced and compiled by the Federal Highway Administration (FHWA), describes various strategies to relieve highway congestion; the mechanisms affecting demand, capacity, and performance; and general guidance on evaluating active traffic management techniques. Strategies discussed include roadway metering, congestion pricing, traveler information systems, managed lanes, traffic signal control, and speed harmonization.

The HCM 2010 examines the use of **alternative tools** in conjunction with techniques presented, applying research conducted under NCHRP Project 3-85. Chapter 6 describes typical applications of HCM and alternative analysis tools, and Chapter 7 offers guidance on interpreting the results from alternative tools. In addition, each methodological chapter contains specific guidance on the application of the tools in analyzing a facility. Several examples illustrate the use of alternative tools in conjunction with the HCM 2010.

To encourage HCM users to consider all travelers, the HCM 2010 incorporates tools for **multimodal analysis** along highway facilities. This is the first edition of the HCM that takes into account the effects of cars on bicyclists and pedestrians. The stand-alone chapters for the bicycle, pedestrian, and transit modes have been eliminated—instead, the methods applicable to bicycles, pedestrians, and transit have been incorporated into the analyses of the various roadway facilities. For methodologies specific to the operation of transit vehicles on urban streets, readers can con-

PHOTO: DAN BURDEN, PEDESTRIAN AND BICYCLE INFORMATION CENTER

A shared pedestrian–bicycle path in San Luis Obispo, California. HCM 2010 updates off-street shared-use path procedures.

sult *TCRP Report 100: Transit Capacity and Quality of Service Manual*.

To assist planners in sizing highway facilities, the HCM 2010 includes **generalized service volume tables** that show the maximum demand volumes for a given LOS under a specified set of conditions. The HCM 2010 also provides **computational engines** to assist users in applying some of the intensive methods.

Additional Changes

Smaller changes have been implemented throughout the manual. For example, the speed–flow curves in the chapter on **basic freeway segments** have been updated with an expanded database. Small changes in the ramps and ramp junctions material—now called **freeway merges and diverges**—check and correct for unreasonable lane distributions. The **two-lane highways** chapter now provides only a one-directional methodology, and several key tables and curves have been updated. Finally, the **off-street shared-use path** procedures have been updated with U.S. data.

Multivolume Format

The new manual has retained many of the stylistic elements introduced in the HCM 2000, such as the page layout formats. The HCM 2010 content, however, is organized into four volumes—Concepts, Uninterrupted Flow, Interrupted Flow, and Applications Guide. The first three volumes are issued as a slipcased set of three looseleaf volumes; Volume 4 is electronic only. The four-volume structure delivers information at several levels of detail, to help HCM users apply and understand the concepts, methodologies, and potential applications.

Volume 1: Concepts presents the basic information that an analyst should master before performing analyses of highway capacity or quality of service. The chapters cover the organization of the HCM 2010; the kinds of applications that can be performed; modal characteristics; traffic flow, capacity, and quality-of-service concepts; the range of tools available to perform an analysis; guidance on interpreting and presenting analysis results; and the terms and symbols used in the HCM 2010. Chapter 8, HCM Primer, offers an executive summary for decision makers.

Volume 2: Uninterrupted Flow contains methodological chapters relating to system elements, as well as the materials and resources needed to analyze these elements. The description of the process thoroughly conveys the steps involved, including the scope and limitations of the methodology, the specific default values, the LOS thresholds, the handling of special cases, and the application of alternative tools.

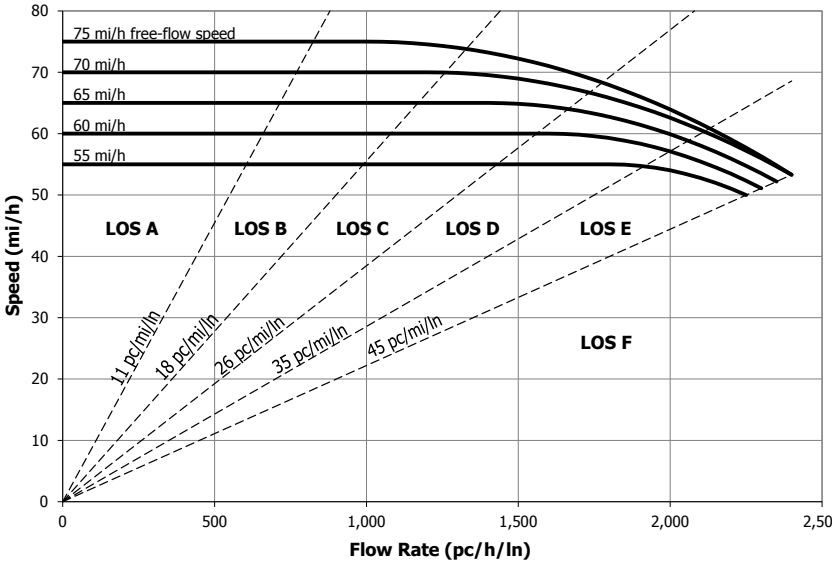
The freeway chapters are presented first, arranged from the facility level to the segment level; the chapters on multilane and two-lane highways follow. Volume 2 incorporates the Part III uninterrupted-flow chapters of the HCM 2000, along with material from the corresponding Part II chapters—such as specific default values and LOS thresholds—used directly in an analysis. The chapter on interchange ramp terminals, which appeared with the uninterrupted-flow chapters in the HCM 2000, appears in Volume 3 of the HCM 2010 with the interrupted-flow chapters.

The methodological chapters of **Volume 3: Interrupted Flow** reflect an approach similar to that of Volume 2, starting with a chapter on urban street facilities, followed by urban street segments, the various intersections, and off-street pedestrian and bicycle facilities. The chapters on urban street facilities and segments provide the highest level of multimodal evaluation, presenting methods to determine LOS for motorists, pedestrians, bicyclists, and transit users.

Web Volume

Volume 4: Applications Guide is an electronic-only volume accessible exclusively to registered HCM

HCM 2010 consists of four volumes—three looseleaf volumes in a slipcased set and one electronic-only volume. To order, visit the TRB online bookstore, http://books.trbbookstore.org/hcm10.aspx.



Freeway speed–flow curves, from HCM 2010, Chapter 11 (LOS = level of service; pc = passenger car; ln = lane).

HCM 2010 Research Resources

The following research projects contributed to the development of the HCM 2010:

- NCHRP Project 3-60, Capacity and Quality of Service of Interchange Ramp Terminals;
- NCHRP 3-60A, Validation and Enhancement of the *Highway Capacity Manual*'s Interchange Ramp Terminal Methodology;
- NCHRP Project 3-64, *Highway Capacity Manual* Applications Guide;
- NCHRP Project 3-65, Applying Roundabouts in the United States;
- NCHRP Project 3-70, Multimodal Level of Service Analysis for Urban Streets;
- NCHRP Project 3-75, Analysis of Freeway Weaving Sections;
- NCHRP Project 3-79, Measuring and Predicting the Performance of Automobile Traffic on Urban Streets;
- NCHRP Project 3-82, Default Values for Capacity and Quality of Service Analyses;
- NCHRP Project 3-85, Guidance for the Use of Alternative Traffic Analysis Tools in Highway Capacity Analyses;
- NCHRP Project 3-92, Production of the 2010 *Highway Capacity Manual*; and
- Two FHWA projects: Evaluation of Safety, Design, and Operation of Shared-Use Paths; and Active Traffic Management Measures for Increasing Capacity and Improving Performance.

users via the Internet. This volume includes four types of content: supplemental chapters on methodological details and emerging issues; interpretations, clarifications, and corrections; comprehensive case studies; and a technical reference library.

Chapters 24 through 34 in Volume 4 supplement chapters in Volumes 1, 2, and 3 with

- More detailed descriptions of selected computational methodologies, written for users who seek a greater depth of understanding or who plan to develop HCM implementation software;
- Example applications of alternative tools to situations not addressed by the methodologies in the chapters of Volumes 2 and 3;
- Descriptions of the computational engines for selected methodologies; and
- Additional example problems and calculation results.

In addition, Chapter 35 in Volume 4 provides a first-generation chapter on the impact of active traffic management techniques on roadway operations. As new research is completed, this chapter will be updated, and chapters may be added to address other emerging issues, such as travel time reliability.

The methodological interpretations section also will continue to develop, as users apply the HCM 2010 and pose questions about particular methodologies to the TRB Highway Capacity and Quality of Service (HCQS) Committee. Clarifications and interpretations of the HCM, as well as corrections, officially approved by the committee will be posted in the interpretations section of Volume 4.

The comprehensive case studies illustrate how to use the HCM to perform common types of analyses. The case studies focus on the analysis process in applying the HCM and alternative tools, not on the step-by-step details of performing calculations—calculations are addressed in the example problems in each methodological chapter and in selected supplemental chapters. Case Studies 1 through 5 derive from the web-based *HCM Applications Guidebook* developed after publication of the HCM 2000, and Case Study 6 was developed in conjunction with NCHRP Project 3-85.

Finally, the Technical Reference Library contains a selection of papers, technical reports, and companion documents cited in the HCM.

Community Collaboration

As the HCM has grown in the decades since its debut in 1951, the content has long since ceased to be the product of a few highly competent experts or of a single technical committee. The HCM 2010 has benefited from the extensive involvement of the professional community to an extent that far surpasses that of previous editions.

A series of practitioner focus groups conducted through NCHRP Project 3-92 and the HCQS Committee supplied valuable insights on the HCM content and organization. More than 300 professionals—many new to TRB—along with members of the HCQS Committee and participants in the manual development process contributed to the year-long review of the chapters.

Four committees from the TRB Technical Activities Operations Section provided reviews and comments on drafts of the manual. Finally, the HCQS Committee's joint summer meetings with local Institute of Transportation Engineers (ITE) sections during the development of the manual, along with focus groups sponsored by ITE, were informative and productive.

The HCQS Committee has invited users of the manual who are interested in improving the profession's understanding of highway capacity and quality of service analysis to participate in the committee deliberations and to provide feedback about the HCM 2010 methods. The committee website, www.AHB40.org, will be available for these interactions.

Wyoming Rural Roads Safety Program

Focusing Locally on High-Risk Segments

KHALED KSAIBATI, MATT CARLSON, AND DON BEARD

Ksaibati is Director, Wyoming Technology Transfer Center, Local Technical Assistance Program, University of Wyoming, Laramie; Carlson is Highway Safety Engineer, Wyoming Department of Transportation, Cheyenne; and Beard is Director, Laramie County Public Works.

A five-step procedure, including field evaluations, helps Wyoming counties obtain funding to improve the safety of rural roads.

Rural roads are critical links in the U.S. transportation system, serving the travel and commerce needs of approximately 60 million Americans. Approximately 80 percent of the nation's roadway miles traverse rural areas. Identifying high-risk rural road segments and determining the safety countermeasures that are most appropriate is an efficient and cost-effective way to improve highway safety.

Problem

Many rural roads are experiencing traffic growth as a result of energy-related economic development; in Wyoming and North Dakota, for example, traffic volumes have increased significantly with drilling activities for oil and gas. Many of these rural roads, however, lack important safety features and experience a far higher rate of serious traffic accidents than other highways.

Approximately 60 percent of traffic fatalities nationwide occur on rural highways. Two-lane roads have the highest fatality rates per vehicle mile of travel.

Solution

The University of Wyoming developed the Wyoming Rural Road Safety Program (WRRSP) to help counties identify high-risk rural roadways and develop a strategy to obtain funding to reduce crashes on the riskiest segments. The Mountain–Plains Consortium (MPC) and the Wyoming Department of Transportation (DOT) funded the development of the WRRSP in cooperation with the Federal Highway Administration (FHWA). A Local Road Safety Advisory Group, with representatives from Wyoming DOT, the Wyoming Local Technical Assistance Program (LTAP), the Wyoming Association of County Engineers and Road Supervisors, the Wyoming Association of Municipalities, and FHWA, supplied guidance for the program.

The pilot phase of the research involved data collection with the participation of Carbon, Laramie, and Johnson counties. The data collected included historical crash data and field conditions. The researchers and counties applied a five-step procedure, involving

1. Crash data analysis;
2. A Level I field evaluation, which examines the roadway's geometric design and its traffic control devices, producing a score of 0 to 10 in five categories;
3. A ranking system to identify potential high-risk locations, with the findings from Steps 1 and 2;
4. A Level II field evaluation to identify problem areas in each road section and determine appropriate countermeasures; and
5. A benefit–cost analysis.

Analysis of the crash data identified segments with proportionately higher crash rates during a 10-year period. A Level I field evaluation revealed deficiencies in geometric conditions and in the roadway shoulders, as well as in pavement markings and signage.

Roadway segments were ranked on a scale of 0 to 10 in five risk categories after the field evaluation:

1. General,
2. Intersection and railroad crossings,
3. Signage and pavement markings,
4. Fixed objects and clear zones, and
5. Shoulder and right-of-way.

PHOTO: WYOMING DOT

TABLE 1 Crash Data and Crash Rankings for Laramie County

Total Crashes	Road No.	Milepost	Crash Ranking
9	210-1	5.01–6.00	1
9	215-3	2.01–3.00	1
9	109-1	1.01–2.00	1
8	124-2	1.01–2.00	4
8	215-3	0.00–1.00	4
7	162-2	9.01–10.00	6
7	215-3	1.01–2.00	6
6	210-1	4.01–5.00	8
6	203-1	17.01–18.00	8
6	212-7	3.01–4.00	8
5	210-1	6.01–7.00	11
5	102-1	3.01–4.00	11
5	209-2	1.01–2.00	11
5	143-2	0.00–1.00	11
5	120-1	4–5, 8–9	11
5	207-1	2.01–3.00	11
4	136-1	3.01–4.00	17
4	109-1	6.01–7.00	17
4	164-1	11.01–12.00	17

Combining the rankings from crash data and field evaluations identified the segments with the highest potential crash risks. Tables 1, 2, and 3 summarize the rankings for Laramie County. A comprehensive analysis of each high-risk segment sought to identify low-cost safety countermeasures for the high-risk segments. A benefit–cost analysis was performed to distinguish the most cost-effective safety measures.

Application

With the success of the pilot study, the Local Road Safety Advisory Group approved the WRRSP procedure for improving the safety of rural roads in Wyoming. A county that completes the five-step procedure has assembled the information necessary for developing a plan to fund safety improvements under the High-Risk Rural Road Program or through other sources of funding. Wyoming DOT is funding some of the counties' safety requests—an incentive for other counties to establish local safety programs.

In the project's second phase, MPC and Wyoming DOT are facilitating statewide implementation of the WRRSP. The University of Wyoming is providing technical assistance and training to counties interested in the program. To date, the university has helped more than one-third of the state's 23 counties implement the program.

Several low-cost safety projects have been approved for funding on roads with the highest risk levels, and 20 safety improvement projects have received funds. The state expects all counties eventually to follow the five-step procedure for identifying high-risk rural road segments and the safety countermeasures.

When the program is fully implemented, the Wyoming Safety Management System Committee will rank the funding requests from the counties to optimize the distribution of available funding. In three years, the University of Wyoming will perform a follow-up study on each of the improved sections, to determine the program's effectiveness in reducing crashes and fatalities. Three years is the minimum time after the installation of safety improvements to obtain meaningful results on the benefits.

Benefits

The methodology developed in this project was presented at the Transportation Research Board's 2009 Annual Meeting and at the annual conference of the National LTAP Association. In addition, workshops and presentations have introduced the process in Wyoming and throughout the Mountain–Plains region. Other states can apply the procedure when considering the distribution of funds to improve the safety of high-risk rural roads. North Dakota has initiated a study similar to the WRRSP.

The program has made $1.5 million available for low-cost safety improvements for local governments

TABLE 2 Level I Field Scores and Rankings for Laramie County

Level I Field Score	Road No.	Milepost	Level I Ranking
16	210-1	5.01–6.00	1
17	136-1	3.01–4.00	2
18	124-2	1.01–2.00	3
18	109-1	6.01–7.00	3
19	210-1	4.01–5.00	5
19	164-1	11.01–12.00	5
20	210-1	0.00–1.00	7
20	102-1	0.00–1.00	7
20	124-2	2.01–3.00	7
21	102-1	2.01–3.00	10
21	109-1	3.01–4.00	10
21	124-2	0.00–1.00	10
21	102-1	1.01–2.00	10
22	210-1	6.01–7.00	14
22	162-2	5.01–6.00	14
22	203-1	7.01–8.00	14
22	136-1	0.00–1.00	14
23	102-1	3.01–4.00	18
23	209-2	1.01–2.00	18

TABLE 3 Combined Rankings for High-Risk Segments in Laramie County

Road No.	Milepost	Overall Score	Combined Ranking
210-1	5.01–6.00	2	1
124-2	1.01–2.00	7	2
210-1	4.01–5.00	13	3
136-1	3.01–4.00	19	4
109-1	6.01–7.00	20	5
164-1	11.01–12.00	22	6
210-1	0.00–1.00	24	7
210-1	6.01–7.00	25	8
102-1	2.01–3.00	27	9
109-1	3.01–4.00	27	10
124-2	0.00–1.00	27	11
102-1	3.01–4.00	29	12
209-2	1.01–2.00	29	13
162-2	5.01–6.00	31	14
162-2	9.01–10.00	31	15
203-1	7.01–8.00	31	16

in the state of Wyoming. In addition, the program will provide steady funding for safety improvements on local roads. Supplying local governments with a funding source for safety improvements is important for ensuring that safety factors are considered at the local level.

As part of the WRRSP, a statewide sign program is being implemented for local governments. Half of the counties in the state have submitted requests for signs at high-risk locations. Wyoming DOT will purchase and distribute more than 1,200 signs for installation by counties, to provide the driving public with advance warning of high-crash locations. The Wyoming LTAP center will conduct a follow-up study to quantify the effectiveness of the improvements.

The program has been a success, demonstrating that local governments can work closely with Wyoming DOT and FHWA to improve the safety of rural roads. For the first time in Wyoming, local governments are able to apply for safety funding by following a systematic procedure.

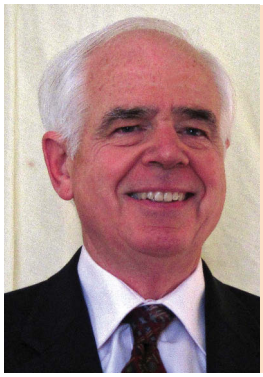
For more information, contact Khaled Ksaibati, Director, Wyoming Technology Transfer Center, University of Wyoming, 1000 East University Avenue, Department 3295, Laramie, WY 82071; 307-766-6230; Khaled@uwyo.edu.

EDITOR'S NOTE: Appreciation is expressed to G. P. Jayaprakash, Transportation Research Board, for his efforts in developing this article, which is the 150th in the *TR News* Research Pays Off series. The series began in the January–February 1983 issue, to document the cost savings achieved through the implementation of research findings.

Robert T. Dunphy

Consultant

Consultant, teacher, and author Robert T. Dunphy has led instrumental research on transportation aspects of land development and the politics of growth. As a consultant, his work has included the redevelopment of Tysons Corner, Virginia, a major suburban center in metropolitan Washington, D.C.; an evaluation of federal transportation stimulus funds on Florida's major regions; a long-term vision for transit in Charlottesville, Virginia; and case studies of sustainable suburbs. At Georgetown University, he teaches a course on transit-oriented development and advises students in the real estate program. He is an emeritus fellow of the Urban Land Institute (ULI), where for more than 20 years he worked with a range of groups to find transportation solutions that sustain urban places.



"Research is essential to understanding the long-term implications of transportation improvements beyond short-term congestion reduction."

"Research is essential for offering creative, effective solutions to a public that is impatient for answers and does not discriminate as to their sources—including experts from other professions," Dunphy observes, noting that transportation research often has been mischaracterized as an impediment to growth and development, when instead it should be seen as a guide. "As researchers, we need to recognize the public's interests and do a better job of communicating what the real choices are and what we recommend," he adds.

Dunphy received a bachelor's degree in civil engineering from the Catholic University of America (CUA) and a master's degree in civil engineering from Texas A&M University. His transportation planning career began with Alan M. Voorhees & Associates. Before joining ULI as Senior Research Director in 1985, he held a senior position with the National Capital Region Transportation Planning Board and was a senior consultant with PRC Engineering. He wrote *Moving Beyond Gridlock: Traffic and Development* in 1997 and *Transportation and Growth: Myth and Fact*, revised in 1996; the works helped establish ULI as a credible source of objective guidance for transportation and land use planning.

In 1999, Dunphy became senior resident fellow at ULI. He directed research and coordinated strategies for planners and developers in the institute's smart growth program, created a shared parking methodology that now serves as the industry standard, collaborated in research projects with the Texas Transportation Institute and the University of California, and led presentations and forums for business and real estate leaders. In 2004, ULI published the best-selling *Developing Around Transit: Strategies and Solutions that Work*, of which Dunphy was lead author and project director, along with several colleagues. He has been a frequent contributor to the ULI magazine, *Urban Land*, as well as to *TR News* and the *Transportation Research Record: Journal of the Transportation Research Board*.

Dunphy traces his interest in transportation planning to his student days at CUA and daily observation of Washington, D.C.'s traffic patterns. "It is somewhat like understanding stream flow, which has many similarities to traffic," he observes. "The difference is that we are dealing with people, who are amazingly complex. Research is essential to understanding the long-term implications of transportation improvements beyond short-term congestion reduction."

Dunphy's outreach efforts have garnered a wide audience, with presentations at national conferences of ULI, TRB, the World Bank, the National Association of Regional Councils, the American Association of State Highway and Transportation Officials, the American Public Transportation Association, the National Governors Association, and Al Gore's summit on climate change, as well as regional programs in more than 30 major U.S. cities and several international programs. He organized a ULI Policy Forum on Congestion Charging in London in 2003.

The importance of parking cannot be overlooked in land development, Dunphy emphasizes: "A developer who comes up with a better parking solution will create better projects with a competitive advantage." He has shared his findings on parking issues in such publications as *Shared Parking* (2005), *Dimensions of Parking* (2000), and *Parking Requirements of Shopping Centers* (1999).

Dunphy is an emeritus member of the TRB Transportation and Land Development Committee, which he joined in 1986 and chaired from 1997 to 2003. In his early years with TRB, Dunphy served on the Transportation Demand Forecasting Committee, Transportation Data and Information Systems Committee, and the Strategies to Implement Benefit-Sharing for Fixed Transit Facilities Committee. He currently is a member of the Transportation Issues in Major U.S. Cities Committee and the planning committee for the Conference on Research Perspectives on Transportation Systems for Livable Communities. Dunphy has chaired two expert task groups for the second Strategic Highway Research Program.

Joseph L. Schofer

Northwestern University

Active in TRB for more than 30 years and a committee chair for several current and past TRB policy studies, Joseph L. Schofer is professor of civil and environmental engineering at Northwestern University, director of the university's Infrastructure Technology Institute (ITI), and associate dean for faculty affairs at the Robert R. McCormick School of Engineering and Applied Science. He shares his expertise in infrastructure with the public as host of the monthly Internet podcast, "The Infrastructure Show," and currently is preparing to deliver two lectures on the Panama Canal for a Northwestern alumni group.

"At the core of my work is an interest in information for decision support—what information do decision makers want and need? What can they understand and use?" Schofer notes.

"Almost everything that goes on around us presents opportunities to learn something useful for our work, because transportation is so tightly intertwined with our society, economy, and environment."

One of the best ways to answer these questions, he has found, is to observe and interact with the decision makers themselves. In 2006, Schofer and several colleagues conducted interviews with a variety of transportation leaders to examine data—the importance of data to decision makers and how they use the data. The results of this research are described in the often-cited TRB Transportation Research Circular E-C109, *Transportation Information Assets and Impacts: An Assessment of Needs*.

A strong source of accurate data assets is essential to the policy-making process, Schofer affirms. "Among the things I've learned is that some policy makers find it easier to base choices on stories—anecdotes—than on data," he observes. "But to be valid, anecdotes must be supported by data, rather than masquerading as data. The task for students, researchers, and transportation professionals is to provide balanced advice based on solid data, quality analyses, and accessible products."

Schofer completed his undergraduate studies in civil engineering at Yale University, and received a master's degree and a Ph.D. in civil engineering from Northwestern. He started as associate professor at Northwestern in 1970, and became a full professor in 1973. He was director of research at the university's Transportation Center from 1979 to 1997 and again from 2001 to 2003 and was chair of the Department of Civil and Environmental Engineering from 1997 to 2002. In 2007, he became director of ITI, which concentrates on developing infrastructure materials and methods for monitoring structural health.

As a professor, Schofer focuses on transportation planning, policy analysis, and evaluation. He advises recent graduates and young professionals to broaden their world view: "Look out the front window. Why are we doing this? What is the value? How can we show what's important to a policy maker who may have little technical training, many preconceptions, and not much time?"

To do this, Schofer notes, it is vital to pay attention to high-quality news reports and thoughtful analyses of issues in the transportation field—and beyond. "Almost everything that goes on around us presents opportunities to learn something useful for our work, because transportation is tightly intertwined with our society, economy, and environment," he points out.

Schofer's long involvement with TRB began with service on the Community Values Committee. He became chair of the committee and continued in that role when it merged with two others in 1970 to become the Transportation Systems Design Committee. Among other TRB Technical Activities assignments, Schofer has served on the National Transportation Data Requirements and Programs Committee, the Data and Information Systems Section, and the Committee for the Workshop on Using National Household Travel Survey Data for Transportation Decision Making.

A TRB policy study drew Schofer into the field of travel data. The study reviewed Bureau of Transportation Statistics' (BTS) flagship surveys and produced TRB Special Report 277, *Measuring Personal Travel and Goods Movement*. This involvement opened the doors for Schofer to explore the various facets of data in use: their value, availability, and quality. He currently chairs two policy study committees—Equity Implications of Evolving Transportation Finance Mechanisms and Strategies for Improved Passenger and Freight Travel Data—an experience he likens to "the intellectual and organizational equivalent of running two marathons at once."

"The value comes not only from immersion in the subject, but also from working with the scholars from transportation and other fields, agency leaders, consultants, and policy makers," Schofer reflects. He adds that service with TRB has three dimensions of value: "the opportunity to obtain and share information in a collaborative setting, the chance to interact with diverse groups of experts in various fields, and the experience of working with staff members."

New Data Sources Clarify Costs of Congestion

New data sources have contributed to the accuracy of the 2010 edition of the Texas Transportation Institute's (TTI) *Urban Mobility Report*. Using INRIX speed data, which show traffic conditions for each day under a variety of different conditions posed by weather, holidays, accidents, work zones, and special events, TTI researchers Tim Lomax, David Schrank, and Shawn Turner have revised congestion trends from 1982 to 2009 and have added 11 new regions to the report.

The researchers found that, after two years of reduced congestion caused by the economic recession, traffic is on the rise. Yearly peak delay for the average commuter was 34 hours in 2009—up from 14 hours in 1982. Topping the list of bad traffic for areas with populations of more than 3 million were Chicago and Washington, D.C., with 70 hours of delay per commuter per year; the Los Angeles, California, area followed with 63 hours of delay. Baltimore, Maryland, had the most traffic for areas with populations between 1 and 3 million, followed by Denver, Colorado, and Minneapolis–St. Paul, Minnesota.

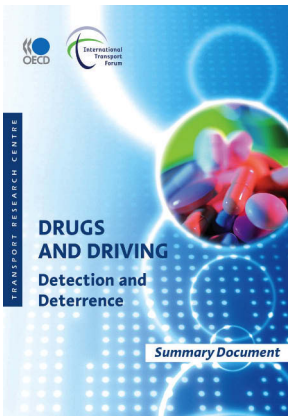
According to the report, congestion delays wasted a total of nearly 4 billion gallons of fuel in 2009. The cost of such congestion was $808 for the average commuter—up from an inflation-adjusted $351 in 1982. Researchers assessed the congestion reduction benefits of public transportation and roadway operations: public transportation saved commuters 785 million hours of delay, 640 million gallons of fuel, and $19 billion in congestion costs, while roadway operational treatments saved 320 million hours of delay, 265 million gallons of fuel, and $8 billion.

To read the full report, visit http://mobility.tamu.edu/ums.

INTERNATIONAL NEWS

Quantifying Crash Risk of Driver Use of Drugs

Examining statistics on drug use and driving, a report from the International Transport Forum (ITF) estimates that the incidence of drug use ranges from 14 to 17 percent among drivers who are killed or injured in road accidents. The ITF report notes that cannabis is the most commonly found substance, followed by benzodiazepines, a class of prescription antidepressants that includes Valium (diazepam) and Xanax (alprazolam).



The ITF study compiled data from roadside tests and surveys from 16 countries. Researchers found that drug use in North America now equals or exceeds alcohol use by drivers. Tests found drugs present in the systems of 40 percent of injured drivers in the Netherlands and in more than one-quarter of 3,400 drivers in Australia who were killed in road accidents. Nearly 20 percent of a survey group of Canadian high school students admitted to driving within one hour of using cannabis.

Case-control studies, crash responsibility studies, and pharmacoepidemiological studies have sought to quantify the crash risk associated with the use of drugs. According to the ITF report, the results of these studies vary, but all agree that the magnitude of the crash risk for a driver under the influence of drugs typically is lower than that for a driver under the influence of alcohol, and that risks increase when drugs and alcohol are combined—even in small amounts. The European Union and the U.S. National Highway Traffic Safety Administration both are funding or conducting research projects on driving under the influence of drugs.

For more information, visit www.internationaltransportforum.org or contact Michael Kloth at Michael.Kloth@oecd.org.

Stephen Perkins (*seated, left*), International Transport Forum (ITF), and Stephen Godwin, TRB, sign a memorandum of understanding to create TRID, a joint international transportation research database; (*standing, left to right:*) TRB Executive Director Robert E. Skinner, Jr.; Véronique Feypell, ITF; Barbara Post, TRB; Jorge Prozzi, University of Texas at Austin, Chair of the TRB International Activities Committee; Birgitta Sandstedt, Swedish National Road and Transport Research Institute; and C. D. van den Braak, Institute for Road Safety Research, the Netherlands.

TRID Integrates Research Databases

TRID is a newly integrated database of records from TRB's Transportation Research Information Services (TRIS) Database and the Organisation for Economic Co-operation and Development's International Transport Research Documentation (ITRD) Database. TRID offers more than 900,000 records of published research on all transportation modes. Also included are records from TRB's Research in Progress (RiP) Database, a clearinghouse of current and recently completed research, as well as ongoing research at University Transportation Centers, funded mostly by federal agencies and state departments of transportation. Users can search the database at trid.trb.org; RiP projects are automatically included in the TRID search, but can be excluded by checking a box below the Simple Search interface.

TRB Webinars Eligible for Professional Credit

The National Council of Examiners for Engineering and Surveying has authorized TRB as a registered continuing education provider, allowing professional development hours (PDH) to be awarded for live TRB webinars. The hours will be accepted by engineering licensing boards in all 50 states and in the District of Columbia, and webinar attendees will receive certificates of completion from TRB.

PDH certificates will be available only to attendees of live webinars—TRB is not authorized to provide certificates for recorded webinars, live meetings, or live conferences. To gain credit, an attendee must register for and attend the webinar as an individual. To access and receive PDH certificates from TRB, attendees should create a free account at www.rcep.net/Join-RCEP/Professionals-1189.htm.

For more information about this and other changes to the TRB webinar program, visit www.trb.org/ElectronicSessions/Webinars1.aspx.

SHARED PERSPECTIVES IN TRANSPORTATION RESEARCH—Executive Director Robert E. Skinner, Jr. (*lower right*), describes TRB's mission and research objectives to a delegation of Iranian researchers, who visited TRB's offices, January 21, 2011, at the National Academies' Keck Center in Washington, D.C. The visitors also attended the TRB 90th Annual Meeting, presented highlights of their research, and explored technical areas of mutual interest.

IN MEMORIAM

George Bugliarello, 1927–2011

National Academy of Engineering (NAE) Foreign Secretary George Bugliarello, an ex officio member of the TRB Executive Committee, died February 18, 2011, in Roslyn, New York. He was 83. The longtime president of the Polytechnic Institute of New York—now the Polytechnic Institute of New York University (NYU)—lived in Port Washington.

Born in Trieste, Italy, Bugliarello studied engineering at the University of Padua; through a Fulbright scholarship to the University of Minnesota, he earned a master's degree in civil engineering. He received a Ph.D. in civil engineering and hydrodynamics from the Massachusetts Institute of Technology in 1959.

Bugliarello taught at Carnegie Mellon University and was dean of engineering at the University of Illinois at Chicago before being named the first president of the Polytechnic Institute of New York in Brooklyn, formed in 1973 through the merger of the Polytechnic Institute of Brooklyn and the NYU School of Engineering and Science.

A forward thinker whose innovations included a computer language for hydrology and hydraulic engineering, establishment of the journal *Technology in Society*, and the first financial engineering graduate program in the United States, Bugliarello founded the urban research park MetroTech, in Brooklyn. In the 1970s and 1980s, the neighborhood surrounding the Polytechnic Institute of New York suffered the effects of economic recession—crime, few jobs, and infrastructure decay. Bugliarello sought to revitalize the area with business, education, and research, and MetroTech opened in 1990. The 16-acre park has proved a strong revitalizing force in the development of downtown Brooklyn.

Bugliarello was elected to the National Academy of Engineering in 1987 for his leadership in technological education and for contributions to biomedical engineering, fluid mechanics, and sociotechnology. He served as president of the Polytechnic Institute of New York until 1994; after that, he continued to teach and write, authoring reports for the United Nations Educational, Scientific, and Cultural Organization. He was NAE's first Foreign Secretary and was editor-in-chief of NAE's quarterly magazine, *The Bridge*.

COOPERATIVE RESEARCH PROGRAMS NEWS

FOCUS ON FREIGHT—Rodney Gregory, Business Transformation Agency (*center*), speaks at a meeting of the National Cooperative Freight Research Program Oversight Committee, with colleagues Emil Frankel, Bipartisan Policy Center (*left*); Barbara A. Ivanov, Washington State Department of Transportation (*second from right*); and Catherine T. Lawson, State University of New York at Albany (*right*). At the January 28 meeting at the Keck Center, the group selected six projects for FY 2011. Project topics included export freight logistics, the impact of dredging on intermodal freight systems, and capacity and level-of-service analyses for trucks.

Guidebook for Sharing Freight Transportation Data

Freight transportation professionals rely on a variety of freight data for management, planning, and improving supply-chain efficiency in shipping. Individual shippers and carriers archive information on shipments, commodity type, volume, schedule, mode, and levels of service; vendors collect real-time data for carriers and shippers; and consultants transform those data into useful management information. Barriers to data sharing include some private entities' fear of releasing proprietary data; the costs of collecting, organizing, storing, and submitting data; and difficulties for some public agencies in signing confidentiality agreements. Research can identify ways to facilitate the sharing of freight data for both public and private sectors.

Cambridge Systematics, Inc., has received a $250,000, 18-month contract (National Cooperative Freight Research Program Project 31, FY 2010) to develop a guidebook on freight data sharing for government agencies, nongovernment organizations, and the private sector.

For more information, contact Joseph D. Navarrete, TRB, 202-334-1649, jnavarrete@nas.edu.

TRB Meetings 2011

May

1–3 International Transportation Economic Development Conference: Economic Impact of Connecting People, Goods, Markets, Employment, Services, and Production*
Charleston, West Virginia

8–12 13th TRB National Transportation Planning Applications Conference
Reno, Nevada

10–11 Transportation Planning, Land Use, and Air Quality Conference
San Antonio, Texas

18–20 3rd International Conference on Roundabouts
Carmel, Indiana

18–20 4th International Transportation Systems Performance Measurement Conference
Irvine, California

June

2–3 5th International Conference on Bituminous Mixtures and Pavements*
Thessaloniki, Greece

5–8 28th International Bridge Conference*
Pittsburgh, Pennsylvania

6–7 Using National Household Travel Survey Data for Transportation Decision Making Workshop
Washington, D.C.

7–9 Joint Harbor Safety Committees and Area Maritime Security Committees Conference*
Houston, Texas

9–11 2nd GeoHunan International Conference: Emerging Technologies for Design, Construction, Rehabilitation, and Inspection of Transportation Infrastructure*
Hunan, China

13–14 Symposium on Mileage-Based User Fees*
Breckenridge, Colorado

14–17 1st International Conference on Access Management*
Athens, Greece

27–30 6th International Driving Symposium on Human Factors in Driver Assignment, Training, and Vehicle Design*
Lake Tahoe, California

28–July 1 6th International Symposium on Highway Capacity and Quality of Service
Stockholm, Sweden

July

10–13 TRB Joint Summer Meeting
Boston, Massachusetts

11–13 National Summit for Rural Traffic Safety Culture*
Big Sky, Montana

11–14 Southern African Transport Conference*
Pretoria, South Africa

17–20 50th Annual Workshop on Transportation Law
Seattle, Washington

24–27 10th International Conference on Low-Volume Roads
Orlando, Florida

25 Geophysical Exploration, Nondestructive Evaluation, and Monitoring Techniques for Landslides, Rockfalls, and Other Geohazards
Lexington, Kentucky

25–26 6th New York City Bridge Conference*
New York, New York

August

20–23 International Visualization in Transportation Symposium
Chicago, Illinois

30–Sept. 1 Emerging Issues in Safe and Sustainable Mobility for Older People
Washington, D.C., area

TBD 19th Biennial Symposium on Visibility and Traffic Control Devices
Minneapolis, Minnesota
Richard Cunard

September

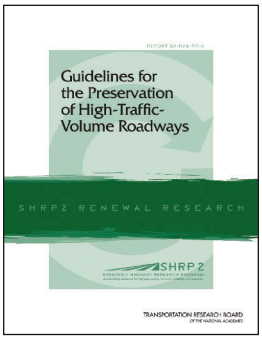
13–16 Smart Rivers 2011: Systems Thinking*
New Orleans, Louisiana

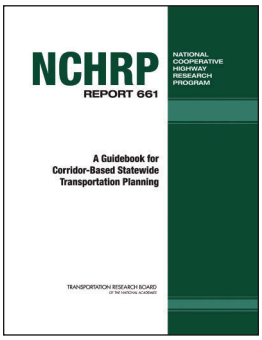
14–16 3rd International Conference on Road Safety and Simulation
Indianapolis, Indiana

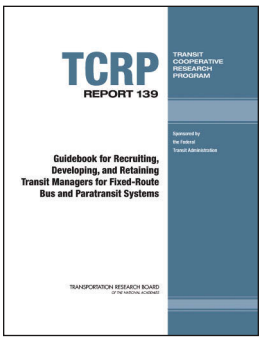
Additional information on TRB meetings, including calls for abstracts, meeting registration, and hotel reservations, is available at www.TRB.org/calendar. To reach the TRB staff contacts, telephone 202-334-2934, fax 202-334-2003, or e-mail TRBMeetings@nas.edu. Meetings listed without a TRB staff contact have direct links from the TRB calendar web page.

*TRB is cosponsor of the meeting.

TRB PUBLICATIONS







Guidelines for the Preservation of High-Traffic-Volume Roadways
SHRP 2 Report S2-R26-RR-2

This report documents the state of the practice for preservation treatment on asphalt and concrete pavements, as well as current practices for low-volume roadways. Derived from a detailed survey of transportation agencies and a review of national and international literature, this volume provides a general framework for how best practices are identified, along with general guidelines for the application of preservation treatments on high-volume roadways. Traffic volume, pavement condition, work-zone requirements, environmental conditions, and expected performance are considered.

2011; 51 pp.; TRB affiliates, $32.25; nonaffiliates, $43. Subscriber categories: highways; maintenance and preservation; materials; pavements.

A Guidebook for Corridor-Based Statewide Transportation Planning
NCHRP Report 661

Designed to help states understand the implications of transportation decisions on mobility, communities, economic development, and environmental stewardship, this guidebook provides a strategic approach to a multimodal, corridor-based, statewide transportation planning process. Included are recommendations for applying results of corridor planning studies and analyses in decision making. This volume concentrates on selecting and defining significant corridors and on using data to develop a long-range statewide transportation plan.

2010; 68 pp.; TRB affiliates, $34.50; nonaffiliates, $46. Subscriber categories: highways; planning and forecasting; environment.

Accelerating Transportation Project and Program Delivery: Conception to Completion
NCHRP Report 662

Recounted in this volume are the experiences of eight state departments of transportation (DOTs) that successfully improved their project delivery. Efforts by DOT employees to communicate across the chain of command, collaborations that have led to trust-based relationships, and partnerships between agencies and the public are explored, along with organizational culture shifts, flat organizational models, greater levels of accountability, and increased interest in regionalization.

2010; 94 pp.; TRB affiliates, $39.75; nonaffiliates, $53. Subscriber categories: highways; administration and management.

Guidebook for Recruiting, Developing, and Retaining Transit Managers for Fixed-Route Bus and Paratransit Systems
TCRP Report 139

This guidebook presents proven strategies for the recruitment, training and development, and retention of managers in fixed-route bus and paratransit systems that are compliant with the Americans with Disabilities Act of 1990 (ADA). Designed for smaller transit systems, the recommendations assume knowledge of human resources management and require adjustment to various organizational circumstances. A supplemental CD-ROM is available for download as an ISO image from TRB's website.

2010; 199 pp.; TRB affiliates, $58.50; nonaffiliates, $78. Subscriber categories: public transportation; administration and management.

A Methodology for Performance Measurement and Peer Comparison in the Public Transportation Industry
TCRP Report 141

Incorporating an array of standardized, nationally available criteria into the peer-selection process, this report explores performance measurement and benchmarking as ways to identify a transit organization's strengths and weaknesses, identify best practices, and set goals. Also described are methods to integrate policy objectives into the process. The methodology provides access to the full National Transit Database and allows users to identify potential peer transit agencies, retrieve standardized performance data for them, and make comparisons.

2010; 110 pp.; TRB affiliates, $41.25; nonaffiliates, $55. Subscriber categories: public transportation; administration and management; planning and forecasting.

Vehicle Operator Recruitment, Retention, and Performance in ADA Complementary Paratransit Operations
TCRP Report 142

Formulated to help public transit agencies increase productivity, manage costs, and improve service quality for passengers on ADA-complementary paratransit services, this report examines the relationships that influence operator recruitment, retention, and performance. Examples of programs, efforts, and industry best practices are included. The principles apply to paratransit services that are contracted out, provided in-house, or operated through a brokerage.

2010; 129 pp.; TRB affiliates, $43.50; nonaffiliates, $58. Subscriber category: public transportation.

TRB PUBLICATIONS *(continued)*

Relationships Between Streetcars and the Built Environment
TCRP Synthesis 86

Amid a resurgence of trolleys and streetcars in the United States, policymakers and planners are interested in how the systems interact with the built environment. This synthesis compiles an overview of the literature, the results of an in-depth telephone survey of more than a dozen U.S. streetcar systems, and case studies of selected streetcar and trolley projects, tracing the evolution of the relationship between trolleys, streetcars, and their environment.

2010; 52 pp.; TRB affiliates, $31.50; nonaffiliates, $42. Subscriber categories: economics; environment; planning and forecasting; public transportation.

North American Marine Highways
NCFRP Report 5

The U.S. marine highway system moves billions of tons of freight each year, but this constitutes less than 4 percent of the nation's domestic freight; in contrast, more than 31 percent of domestic freight traveled by water in 1957. This report examines the potential for moving more intermodal containers via the marine highway system—leading to possible reductions of fuel consumption, air pollution, greenhouse gas emissions, and highway and railroad choke points. Included are an assessment of the conditions for feasibility and an analysis of economic, technical, regulatory, and logistical barriers.

2010; 99 pp.; TRB affiliates, $39.75; nonaffiliates, $53. Subscriber categories: freight transportation; marine transportation; operations and traffic management; policy; terminals and facilities.

Pavement Management 2010, Volume 2
Transportation Research Record 2154

Research is presented on models of subbase erosion for concrete pavement design, the effectiveness of dowels in jointed-concrete pavements with faulting data from rapid-travel profilers, an expert system for designing low-volume roads over expansive soils, longitudinal joint data collection efforts in Virginia, an investigation of a hot-mix asphalt dynamic modulus using field-measured pavement response, unbound aggregate deformation behavior caused by traffic wander, a process to estimate permit costs for heavy trucks on flexible pavements, and other subjects.

2010; 196 pp.; TRB affiliates, $56.25; nonaffiliates, $75. Subscriber categories: highways; pavements; materials.

Pavement Management 2010, Volume 3
Transportation Research Record 2155

The papers in this volume explore various aspects of pavement rehabilitation, surface properties, and pavement–vehicle interaction, addressing topics such as a tool for reflection cracking–based asphalt overlay thickness design and analysis, an assessment of fracture parameters to predict field cracking performance of cold in-place recycling mixtures, spall repair methods and equipment for airfield pavements, the impact of wide-base single tires on pavement damage, friction of patterned and textured pavements, and a network-level pavement roughness prediction model for rehabilitation.

2010; 178 pp.; TRB affiliates, $54; nonaffiliates, $72. Subscriber categories: highways; pavements.

Travel Behavior 2010, Volume 1
Transportation Research Record 2156

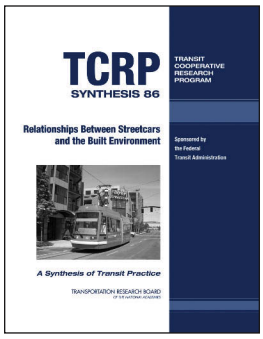
Car ownership among young adults, a probit-based discrete-continuous model of activity choice, strategic thinking and risk attitudes in route choice, the impact of immigrant status on household auto ownership, experimental economics in transportation, a data-mining approach to work trip mode choice analysis, the ways in which accessibility shapes the acquisition and disposal of cars, and a disaggregated empirical analysis of the determinants of urban travel greenhouse gas emissions are some of the paper topics covered in this volume.

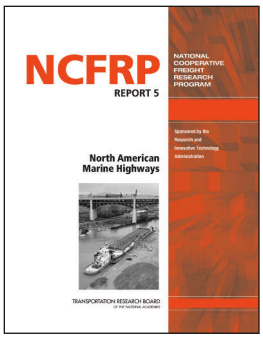
2010; 169 pp.; TRB affiliates, $46.50; nonaffiliates, $62. Subscriber categories: highways; public transportation; pedestrians and bicyclists; planning and forecasting; passenger transportation; economics; environment; data and information technology.

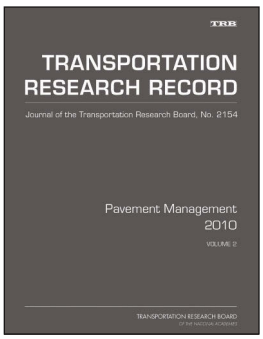
Travel Behavior 2010, Volume 2
Transportation Research Record 2157

Authors present research on behavioral biases in travel demand analysis; changes in travel behavior in response to weather conditions; public holidays' effect on travel time expenditure; sociodemographics, activity participation, and trip chaining between household heads; the multitasking behavior of public transportation users; route choice behavior with mobile phone trajectories; sense-of-place attitudes as indicators of travel behavior; vehicle emission control strategies and public opinion; a hedonic price model for light-duty vehicles; the influence of e-shopping on shopping travel; and more.

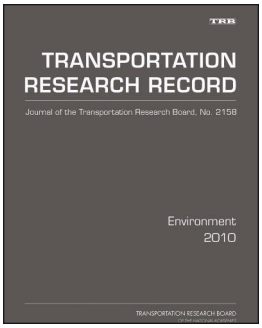
2010; 154 pp.; TRB affiliates, $51; nonaffiliates, $68. Subscriber categories: highways; public transportation; pedestrians and bicyclists; planning and fore-







TRB PUBLICATIONS *(continued)*



casting; passenger transportation; economics; environment; data and information technology.

Environment 2010
Transportation Research Record 2158

The papers in this volume examine diesel vehicle emission factors for short road segments; transportation and land use policy effects on air quality; a bus technology meta-analysis; modal emissions and traffic simulation models; portable emission measurement systems; emissions sensitivity to traffic volume, fleet composition, and average speed; cold start emissions from light-duty vehicles; the acoustic aging of road pavements; an environmental and sustainability impact assessment of infrastructure in the United Kingdom; and other subjects.

2010; 150 pp.; TRB affiliates, $51; nonaffiliates, $68. Subscriber categories: highways; public transportation; environment; pavements; vehicles and equipment; materials; planning and forecasting.

Railways 2010
Transportation Research Record 2159

High-speed rail projects, emissions and energy consumption of high-speed trains, passenger rail crew scheduling, railway infrastructure charging, and a risk analysis of transporting hazardous materials by rail are explored, along with topics such as force characteristics of longitudinally coupled slab track turnout on bridges, ultrasonic guided waves in rails, freezing-induced cracks in the concrete sleepers of high-speed railways, and railroad ballast evaluation using ground-penetrating radar.

2010; 117 pp.; TRB affiliates, $44.25; nonaffiliates, $59. Subscriber categories: railroads; passenger transportation; freight transportation; planning and forecasting.

Data Systems and Travel Survey Methods 2010
Transportation Research Record 2160

Research is presented on transportation asset management, road inventory data collection and integration, travel time estimation algorithms, travel data collection using Bluetooth sensors, nonintrusive sensors for vehicle classification, temporal data aggregation, axle load measurement errors, cluster analysis of traffic data, volume data correction for single-channel advance loop detectors, automated vehicle identification at weigh-in-motion inspection stations, collecting local freight data, and more.

2010; 168 pp.; TRB affiliates, $51; nonaffiliates, $68. Subscriber categories: highways; motor carriers; public transportation; data and information technology; freight transportation; maintenance and preservation; operations and traffic management.

Traffic Flow Theory 2010: Simulation Modeling
Transportation Research Record 2161

The six papers in this volume explore a lane-changing model based on driver behavior, a lane-changing model of multiclass vehicles under heavy traffic conditions, simulation-based traffic prediction for incident management, traffic simulation that employs data archives of intelligent transportation systems, a macroscopic fundamental diagram using simulation data, and calibrated simulation models of future systems.

2010; 56 pp.; TRB affiliates, $39; nonaffiliates, $52. Subscriber categories: highways; operations and traffic management; planning and forecasting.

Freight Systems: Intermodal Transportation, Hazardous Materials, and International Trade
Transportation Research Record 2162

Topics addressed in this volume include stacking priority rules, scheduling trucks at cross-docks, system efficiency at container terminals, the impact on air pollution of shifting freight from truck to rail, freight mobility constraints, the use of passenger rail infrastructure for goods movement, road corridor investments in Kazakhstan, documenting truck activity times at international border crossings, and developing a prioritization application for hazardous materials shippers.

2010; 116 pp.; TRB affiliates, $44.25; nonaffiliates, $59. Subscriber categories: motor carriers; marine transportation; railroads; freight transportation; operations and traffic management; environment; data and information technology; economics.

The TRR Journal Online website provides electronic access to the full text of more than 11,000 peer-reviewed papers that have been published as part of the Transportation Research Record: Journal of the Transportation Research Board *(TRR Journal) series since 1996. The site includes the latest in search technologies and is updated as new TRR Journal papers become available. To explore the TRR Online service, visit www.TRB.org/TRROnline.*

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INFORMATION FOR CONTRIBUTORS TO

TR NEWS

TR News welcomes the submission of manuscripts for possible publication in the categories listed below. All manuscripts submitted are subject to review by the Editorial Board and other reviewers to determine suitability for *TR News*; authors will be advised of acceptance of articles with or without revision. All manuscripts accepted for publication are subject to editing for conciseness and appropriate language and style. Authors receive a copy of the edited manuscript for review. Original artwork is returned only on request.

FEATURES are timely articles of interest to transportation professionals, including administrators, planners, researchers, and practitioners in government, academia, and industry. Articles are encouraged on innovations and state-of-the-art practices pertaining to transportation research and development in all modes (highways and bridges, public transit, aviation, rail, and others, such as pipelines, bicycles, pedestrians, etc.) and in all subject areas (planning and administration, design, materials and construction, facility maintenance, traffic control, safety, geology, law, environmental concerns, energy, etc.). Manuscripts should be no longer than 3,000 to 4,000 words (12 to 16 double-spaced, typed pages). Authors also should provide appropriate and professionally drawn line drawings, charts, or tables, and glossy, black-and-white, high-quality photographs with corresponding captions. Prospective authors are encouraged to submit a summary or outline of a proposed article for preliminary review.

RESEARCH PAYS OFF highlights research projects, studies, demonstrations, and improved methods or processes that provide innovative, cost-effective solutions to important transportation-related problems in all modes, whether they pertain to improved transport of people and goods or provision of better facilities and equipment that permits such transport. Articles should describe cases in which the application of project findings has resulted in benefits to transportation agencies or to the public, or in which substantial benefits are expected. Articles (approximately 750 to 1,000 words) should delineate the problem, research, and benefits, and be accompanied by one or two illustrations that may improve a reader's understanding of the article.

NEWS BRIEFS are short (100- to 750-word) items of interest and usually are not attributed to an author. They may be either text or photographs or a combination of both. Line drawings, charts, or tables may be used where appropriate. Articles may be related to construction, administration, planning, design, operations, maintenance, research, legal matters, or applications of special interest. Articles involving brand names or names of manufacturers may be determined to be inappropriate; however, no endorsement by TRB is implied when such information appears. Foreign news articles should describe projects or methods that have universal instead of local application.

POINT OF VIEW is an occasional series of authored opinions on current transportation issues. Articles (1,000 to 2,000 words) may be submitted with appropriate, high-quality illustrations, and are subject to review and editing. Readers are also invited to submit comments on published points of view.

CALENDAR covers (*a*) TRB-sponsored conferences, workshops, and symposia, and (*b*) functions sponsored by other agencies of interest to readers. Notices of meetings should be submitted at least 4 to 6 months before the event.

BOOKSHELF announces publications in the transportation field. Abstracts (100 to 200 words) should include title, author, publisher, address at which publication may be obtained, number of pages, price, and ISBN. Publishers are invited to submit copies of new publications for announcement.

LETTERS provide readers with the opportunity to comment on the information and views expressed in published articles, TRB activities, or transportation matters in general. All letters must be signed and contain constructive comments. Letters may be edited for style and space considerations.

SUBMISSION REQUIREMENTS: Manuscripts submitted for possible publication in *TR News* and any correspondence on editorial matters should be sent to the Director, Publications Office, Transportation Research Board, 500 Fifth Street, NW, Washington, DC 20001, telephone 202-334-2972, or e-mail jawan@nas.edu.

◆ All manuscripts should be supplied in 12-point type, double-spaced, in Microsoft Word 6.0 or higher versions, on a CD or as an e-mail attachment.

◆ Submit original artwork if possible. Glossy, high-quality black-and-white photographs, color photographs, and slides are acceptable. Digital continuous-tone images must be submitted as TIFF or JPEG files and must be at least 3 in. by 5 in. with a resolution of 300 dpi or greater. A caption should be supplied for each graphic element.

◆ Use the units of measurement from the research described and provide conversions in parentheses, as appropriate. The International System of Units (SI), the updated version of the metric system, is preferred. In the text, the SI units should be followed, when appropriate, by the U.S. customary equivalent units in parentheses. In figures and tables, the base unit conversions should be provided in a footnote.

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