TR News: January-February 2005 All Aboard for Railway Safety Rulemaking

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COVER: The active, coordinated involvement of all stakeholders is increasing the effectiveness of federal measures for railroad and rail worker safety.
(Photo courtesy of Jon Waide, WaidePhotoReadyReserve)

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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ALSO IN THIS ISSUE:

COMING NEXT ISSUE

School transportation is the focus of feature articles in the March–April *TR News*—including emissions impacts on neighborhoods, alternative fuels, child passenger safety, the application of automated vehicle location systems for school buses, insights from practices in the Netherlands, and more. Plus, photographic highlights and summary reports recap TRB's 84th Annual Meeting.

A sizable crowd listens attentively to briefings at the New and Young Attendees Welcome Session and Networking Reception, Sunday, January 9, at the TRB Annual Meeting.

Transit's Complex Route to Improved Standards and Codes

Keeping Pace with Innovations

JEFFREY G. MORA AND WILLIAM P. CHERNICOFF

Mora retired in 2004 as Transportation Systems Manager, Office of Research, Federal Transit Administration, where he worked for more than 33 years. Chernicoff is General Engineer, Research and Special Programs Administration, U.S. Department of Transportation.

The transit industry—which includes government, operators, and suppliers—has become increasingly interested and active in the development and revision of standards. In some ways, the trend has come full circle.

In the early 1900s, as the electric streetcar and interurban systems expanded, private operators and the American Electric Railway Association—the predecessor to the American Public Transportation Association (APTA)—developed industry standards for equipment, electrification, accounting, and other concerns. The standards represented a consensus on how best to manage a diverse industry operating largely under private ownership. When the nation's streetcar and interurban systems went bankrupt—mostly during the Great Depression—the extensive body of standards fell into neglect.

Today, advanced technologies are being developed and applied in bus and rail transit and bus systems service. New codes, standards, and best practices are necessary to ensure safety and to establish uniform, accepted practices for equipment design, maintenance, and operations.

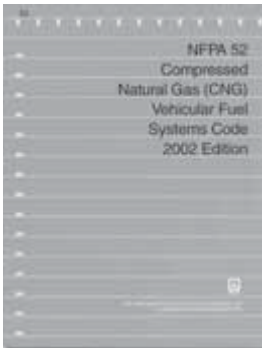
Attention to Standards

The transit industry's renewed attention to standards, regulations, and best practices stems from several causes:

- The public expects the highest levels of safety in transit vehicles and services;
- Vehicle and equipment prices are increasing—standards lower the risk of investment and curtail price increases by encouraging wider use of compliant vehicles and equipment; and
- Common, defined interfaces are needed to ensure the interoperability of components and subsystems from different manufacturers—notably, for advanced rail signaling and communications systems.

The rapid pace at which new technology is introduced and the diversity of product choices require adherence to codes, standards, and best practices to meet expectations for vehicle performance, safety, reliability, and durability.

The rail transit industry rediscovered the importance of standards when commuter rail system



The transit industry adheres to many established standards, including the National Fire Protection Association's fire safety code.

operators participated in the Federal Railroad Administration's consensus rulemaking on Passenger Rail Equipment Safety Standards, from 1997 to 1999; APTA and transit agencies also were involved. In addition, a Transit Cooperative Research Program (TCRP) project[1] began a successful effort to develop electrical interface standards for rail vehicles (*1*). The Institute of Electrical and Electronics Engineers (IEEE) has voted on and approved 14 of the TCRP project's recommended standards, and other new standards are in approval.

In 2001, the Federal Transit Administration (FTA) awarded APTA a research grant to continue work on rail system standards, with grade crossings the first area of emphasis. Finally, FTA and the Intelligent Transportation Systems Joint Program Office of the U.S. Department of Transportation, under contract with the Institute of Transportation Engineers, are developing standards for transit communications interfaces.

Sources of Standards

An impressive number of engineering and related organizations publish standards and codes that affect both the fixed guideway and bus modes of the transit industry (see box). These standards and codes address facilities, equipment and systems design, and maintenance and operations.

In the bus industry, a new effort is under way for bus vehicle standards, through a cooperative venture of TCRP, APTA, and the Society of Automotive Engineers (SAE). SAE establishes hundreds of standards that affect bus design and component testing.

The joint project is revising and updating the SAE standards for buses, usually included under truck standards. The focus is on bus-related issues—for example, on standards that cover the unique driving cycles and emissions measurements for hybrid electric buses.[2]

Alternative Fuels Standards

Alternative fuels safety is an important issue for transit operators, FTA, the National Highway Traffic Safety Administration, industry trade associations, and relevant standards development organizations in the United States and Canada. In the late 1980s, FTA implemented a Clean Fuels Program by funding the purchase of buses powered by compressed natural gas (CNG) and by alcohol fuels. Many transit operators considered the CNG technology ready to use, because several transit systems—notably the Chicago Transit Authority—had operated fleets of propane-fueled buses in the 1950s and 1960s.

Nonetheless, problems became evident as operators made the transition to CNG-fueled vehicles. One problem was that the pressure relief devices (PRD) on the gas cylinders had a tendency to fail, even without a proximate cause such as a fire. As a result, gas would be released randomly, usually under high pressure.

[1] TCRP Project G-4, Developing Standards for System and Subsystem Interfaces in Electric Rail Passenger Vehicles.

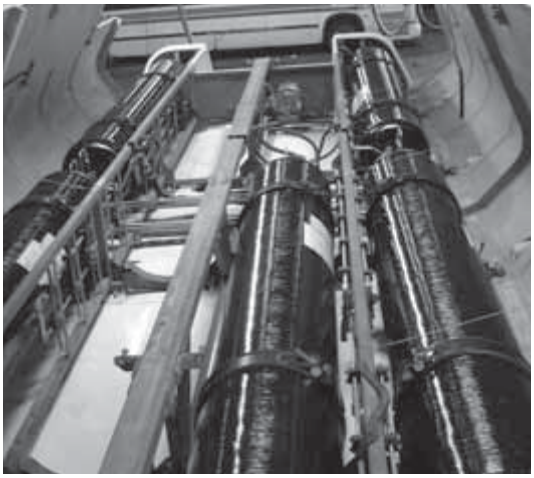
[2] SAE J2711, Recommended Practice for Measuring Fuel Economy and Performance of Hybrid-Electric and Conventional Heavy-Duty Vehicles.

Sample Organizations Developing Standards for Transit

Nongovernment Groups
American National Standards Institute
American Public Transportation Association
American Society of Civil Engineers
American Society of Heating, Refrigerating, and Air-Conditioning Engineers
American Society of Mechanical Engineers
CSA International
Institute of Electrical and Electronics Engineers
Institute of Transportation Engineers
National Fire Protection Association
Society of Automotive Engineers

Government Agencies
Architectural Transportation Barriers Compliance Board
Federal Highway Administration
Federal Railroad Administration
National Highway Traffic Safety Administration
U.S. Coast Guard
California Public Utilities Commission
Local, county, and state agencies responsible for building codes

CNG-powered bus in Akron (Ohio) Metro system; the CNG fuel cylinders are mounted on the bus roof, beneath the housing.



CNG fuel cylinders, fuel lines, and safety devices under bus roof.

Bus manufacturers, component suppliers, and the natural gas industry worked to improve the performance of PRDs through design changes and revisions to the standard.[3] These efforts eventually led to a decline in PRD failures.

In the meantime, however, the random gas releases often occurred inside maintenance facilities. Some facilities were warmed by open-flame gas-powered heaters, which could trigger fires or explosions.

High-Pressure Incident

In a transit bus maintenance facility in Southern California in 1994, a PRD failed and released gas under high pressure. The incident drew transit industry and government attention to the lack of an industry standard governing the use of open-flame heaters near a source of natural gas.

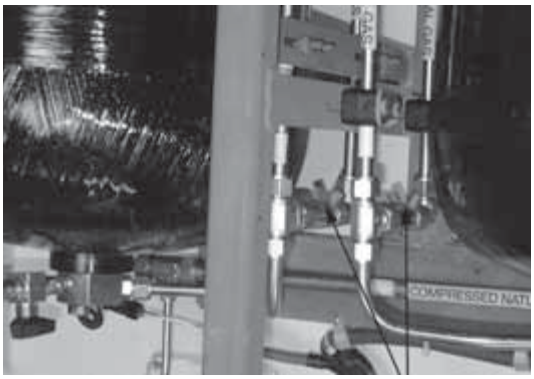
The industry standards had addressed the potential failure of PRDs in bus equipment but had not considered the additional potential hazards within a bus maintenance facility. For example, gas released at high pressure could rise rapidly to heating devices in the ceiling. This gap in a key standard was referred to the National Fire Protection Association (NFPA) for immediate attention.

The NFPA code for enclosed maintenance facilities had not specifically prohibited open-flame heaters from an area in which combustible quantities of natural gas could be released. The California facility had met the requirements for safety equipment—such as gas detectors, ventilation fans, and sprinklers—but the incident demonstrated that the behavior of natural gas released under high pressure was not well understood (2).

Coordinating the Response

After the incident, FTA initiated a multipart effort to mitigate the potential for similar occurrences. First, the agency reported the incident to all transit agencies that were operating gaseous-fuel buses and suggested steps to mitigate the risks of using open-flame heaters in enclosed bus facilities.

FTA then worked with the bus transit and gas industries to develop a guidance document for transit bus operators using or planning to use CNG-fueled



Pressure-relief devices adjacent to CNG cylinders.

[3] Pressure Relief Devices for Natural Gas Vehicle (NGV) Fuel Containers, ANSI/IAS PRD-1-1998.

PHOTO: SRTD

Fueling station for CNG-powered buses, Sacramento (California) Regional Transit District.

buses, to assist in designing or renovating bus maintenance and storage facilities. Finally, FTA worked actively with an NFPA committee to revise the code, adding a prohibition against using open-flame heaters in enclosed maintenance facilities. All of these efforts were successful.

The NFPA Code for Motor Fuel Dispensing Facilities and Repair Garages was modified through a national comment and revision process (*3*). In addition, a new industry guidance document, sponsored by FTA, was prepared with the assistance of an industry committee with representatives from the natural gas industry, bus operators, consultants, NFPA, gas utilities, the Volpe National Transportation Systems Center, FTA, and APTA. The document, *Design Guidelines for Bus Transit Systems Using Compressed Natural Gas as an Alternative Fuel*, synthesized best practices and lessons learned from facilities and bus design and from operating and maintenance practices (*4*).

Applying the Lessons

The transit industry's acceptance of the CNG guidance document led FTA to work with similar industry committees to develop guidance documents for the other principal alternative fuels in use or projected for use in transit—such as alcohol fuels, propane, liquefied natural gas, and hydrogen (*5–8*).

In 2003, FTA, the Volpe Center, and industry experts looked to the future and completed a guidance document for electric and hybrid electric buses and related facilities (*9*). Electric and hybrid electric vehicles and facilities have experienced a disproportionately high rate of incidents—particularly vehicle fires—as well as maintenance difficulties. A primary aim of the newest FTA design guidelines is to prevent these problems.

The government and the transit industry have learned and continue to learn about the problems of introducing new fuels and propulsion technologies into transit. Similar start-up problems in coping with technologically advanced equipment also have occurred in the rail sector, but the safety issues associated with the introduction of gaseous fuels into bus transit were not resolved until after incidents occurred.

Alternatively, several years might have been spent in performing complex analyses of failure modes, effects, and related risks to determine what might happen when introducing a high-pressure flammable fuel into transit operations. Appropriate industry standards and best practices could have been developed, line employees could have been trained, and other preparations could have been put in place before the new vehicles went into service. Instead, some of those steps had to be taken after the equipment was introduced.

PHOTO: WMATA

Refueling CNG-powered bus in Washington (D.C.) Metropolitan Area Transit Authority facility.

Photo: SRTD

Sacramento Regional Transit District garage rooftop, showing GNG bus fueling complex.

New Generation Fuels

The transit industry is still learning how to make operations safer. Interested organizations, including APTA and FTA—with technical support from the Volpe Center—are working with industry standards development organizations to revise key standards and codes more than a decade after the first CNG and liquid natural gas buses entered transit service. With a new generation of bus propulsion technologies—such as hybrids and fuel cells—entering the transit marketplace, the process of technology development and refinement will continue for the next decade.

In the area of alternative fuels for bus transit—including the new generation of electric and hybrid buses—more than one organization has standards or codes that affect the design, maintenance, and operation of vehicles:

- SAE primarily influences bus equipment and materials;
- NFPA addresses facility design and fire safety;
- CSA International addresses pressure relief devices and gas cylinders; and
- IEEE and NFPA—which publish the National Electrical Code—are interested in the electrical component of facility design.

Moreover, these standards and codes frequently are incorporated into local building codes and then enforced by local fire marshals.

Refining Standards

Most of the safety and performance incidents and problems related to alternative fuels in transit were unexpected. Designing for 100 percent safety assurance is difficult, but foresight and reliance on a variety of industry standards, codes, and guidance documents will assist in mitigating the risks inherent in the operation of buses powered by nonconventional fuels and propulsion systems.

These experiences show the importance of beginning the development or refinement of applicable codes, standards, and best practices before and in conjunction with the introduction of new technologies, to mitigate the risks and to improve safety and performance. When new-technology transit vehicles are introduced into use, failures will become evident, particularly failures affecting safety. At this stage, therefore, industry experts once again should continue to examine the standards and codes for potential modifications.

Even when the codes and standards for the transit vehicles may not be current, an active maintenance and supervision schedule can ensure initial safety. New technology vehicles can serve as a valuable resource for the development of standards before the technologies come into widespread commercial use.

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3. *NFPA 30A Code for Motor Fuels Dispensing Facilities and Repair Garages*. National Fire Protection Association, Quincy, Massachusetts, 2000.
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Consensus Rulemaking at the Federal Railroad Administration

All Aboard for Railway Safety Measures

GRADY C. COTHEN, JR., CHRISTOPHER F. SCHULTE, JEFFREY D. HORN, AND DAVID C. TYRELL

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Since the mid-1990s, the Federal Railroad Administration (FRA) has promoted early and extensive participation by all interested parties in the agency's regulatory processes. FRA and industry stakeholders continue to evaluate this collaborative effort as necessary, productive, and beneficial. Two of these successful efforts demonstrate alternative approaches to working with stakeholders:

- The Roadway Worker Protection regulations, which proceeded by formal negotiated rulemaking; and
- The proposed rule for locomotive crashworthiness, which progressed through the Railroad Safety Advisory Committee (RSAC).

Both approaches have served the agency and the industry well; FRA, however, is focusing on the RSAC approach as better suited to the needs of the specialized field of railroad safety. Both approaches rely on representative working groups.

Working Groups

The working group on roadway worker protection was established after a series of roundtable meetings in 1993 on all aspects of FRA's safety program. Working groups on passenger equipment safety standards and on passenger train emergency preparedness followed in 1995. All three government–industry working groups developed approaches accepted by FRA and incorporated into regulations (*1*–*3*).

The success of the working groups, as well as of the roundtable discussions, convinced FRA to change the traditional hear-and-decide regulatory procedure for railroad safety into a consensus model involving the parties that are benefited or burdened by the regulations. The concept was that decisions about the best approach to safety should be made with full participation of all affected parties.

In 1996, FRA established the RSAC, which provides a forum for consensus rulemaking and program development. The committee includes representatives from all of the agency's major customer groups,

including railroads, labor organizations, suppliers and manufacturers, state agencies, passenger organizations, and other interested parties (see list, Table 1).

RSAC is charged with considering major safety regulatory issues. With the advice of working groups, the committee determines what information or analysis may be required, considers the relevant benefits and costs of alternative actions, and recommends to FRA an approach to address each concern—for example, continued implementation of current measures, voluntary initiatives, amendments to regulations, or proposals of new requirements.

Roadway Worker Protection

In 1990, the Brotherhood of Maintenance-of-Way Employes (BMWE) petitioned FRA to amend the Federal Track Safety Standards to address hazards to roadway workers—the maintenance-of-way workers and others who maintain signals and bridges. An Advance Notice of Proposed Rulemaking in November 1992 announced proceedings to amend the federal track safety standards.

Workshops were held to solicit the views of the public. After a March 1993 workshop to discuss related petitions for emergency orders and requests for rulemaking from BMWE and the Brotherhood of Railroad Signalmen, FRA decided to initiate a separate effort to consider roadway worker safety regulations.

FRA convened a meeting of railroad contractors, railroad management, and labor representatives in June 1994 to discuss possible actions and to review roadway worker casualty data. FRA suggested a negotiated rulemaking process, a collaborative effort that would allow input from all interested parties.

In August 1994, FRA published a notice to establish a Federal Advisory Committee, including a framework for the negotiations (*4*). According to the framework, the committee report would identify any items that did not achieve consensus, and FRA would propose a rule as recommended by the committee, unless the recommendations were inconsistent with statutory or legal requirements. In addition, FRA would address items not adequately dealt with by the advisory committee.

In December 1994, the Office of Management and Budget approved the charter for a Roadway Worker Safety Advisory Committee. The first negotiating session was held in January 1995, under the auspices of the Federal Mediation and Conciliation Service. The 25-member advisory committee included representatives from the organizations listed in Table 2.

The committee convened seven negotiating sessions with neutral, outside facilitators. The first meeting included a presentation by members of an independent task force of industry representatives that

TABLE 1 RSAC Member Groups

American Association of Private Railroad Car Owners
American Association of State Highway and Transportation Officials
American Public Transportation Association
American Short Line and Regional Railroad Association
American Train Dispatchers Association
Association of American Railroads
Association of Railway Museums
Association of State Rail Safety Managers
Brotherhood of Locomotive Engineers and Trainmen
Brotherhood of Maintenance of Way Employes
Brotherhood of Railroad Signalmen
Federal Transit Administration*
High Speed Ground Transportation Association
Hotel Employees & Restaurant Employees International Union
International Association of Machinists and Aerospace Workers
International Brotherhood of Boilermakers and Blacksmiths
International Brotherhood of Electrical Workers
Labor Council for Latin American Advancement*
League of Railway Industry Women*
National Association of Railroad Passengers
National Association of Railway Business Women*
National Conference of Firemen and Oilers
National Railroad Construction and Maintenance Association
National Railroad Passenger Corporation (Amtrak)
National Transportation Safety Board*
Railway Supply Institute
Safe Travel America
Secretaria de Communicaciones y Transporte*
Sheet Metal Workers International Association
Tourist Railway Association, Inc.
Transport Canada*
Transport Workers Union of America
Transportation Communications International Union
United Transportation Union

* Nonvoting.

PHOTO: JOHN WAIDE, WAIDEPHOTOREADYRESERVE

Union Pacific tie crew working in Tempe, Arizona.

TABLE 2 Roadway Workers Protection Working Group Members

American Public Transportation Association
American Short Line and Regional Railroad Association
Association of American Railroads
Brotherhood of Locomotive Engineers and Trainmen
Brotherhood of Maintenance of Way Employes
Brotherhood of Railroad Signalmen
Burlington Northern Railroad
Consolidated Rail Corporation
CSX Transportation, Inc.
Florida East Coast Railway Company
National Railroad Passenger Corporation (Amtrak)
Norfolk Southern Corporation
Northeast Illinois Regional Railroad Corporation
Regional Railroads of America
Transport Workers Union of America
Union Pacific Railroad Company
United Transportation Union

had met during the preceding year, analysis of the task force data, and information presented by other advisory committee members.

The meetings produced consensus on 11 specific recommendations and 9 general recommendations. In May 1995, the recommendations were presented in a report to the Secretary of Transportation and the Federal Railroad Administrator. The report established the basis for the proposed rule but not for the planned Notice of Proposed Rulemaking (NPRM). Therefore the committee held an additional two-day session to obtain consensus for a proposed regulation.

FRA published the NPRM in March 1996. FRA also solicited and received comments from contractors and from tourist railroads, two groups not represented on the committee. The final advisory committee meeting was held in July 1996 to consider comments submitted to the docket.

The final rule on roadway worker protection was published in the *Federal Register,* December 16, 1996, with an effective date of January 15, 1997 (*1*). All railroads that are part of the general system of transportation were required to comply by mid-1997; each railroad had to adopt an on-track safety program with an internal monitoring process.

Regulatory Benefit

In the 11-year period preceding the regulation, railroad roadway workers sustained 4.81 fatalities per year; in the 7-year period after the regulation, the fatality rate fell to 2.50 per year. The 48 percent reduction in the fatality rate indicates that the regulation has been effective (see Figure 1, below). The data represent only the fatalities linked to on-track safety and do not include fatalities from other causes, such as crane lifting incidents.

Negotiated Rulemaking

The negotiated rulemaking for roadway worker protection was the first in FRA history, and the committee worked under close scrutiny. Although the committee was staffed by knowledgeable representatives of the organizations involved, the facilitators were not familiar with the terminology, rules, and

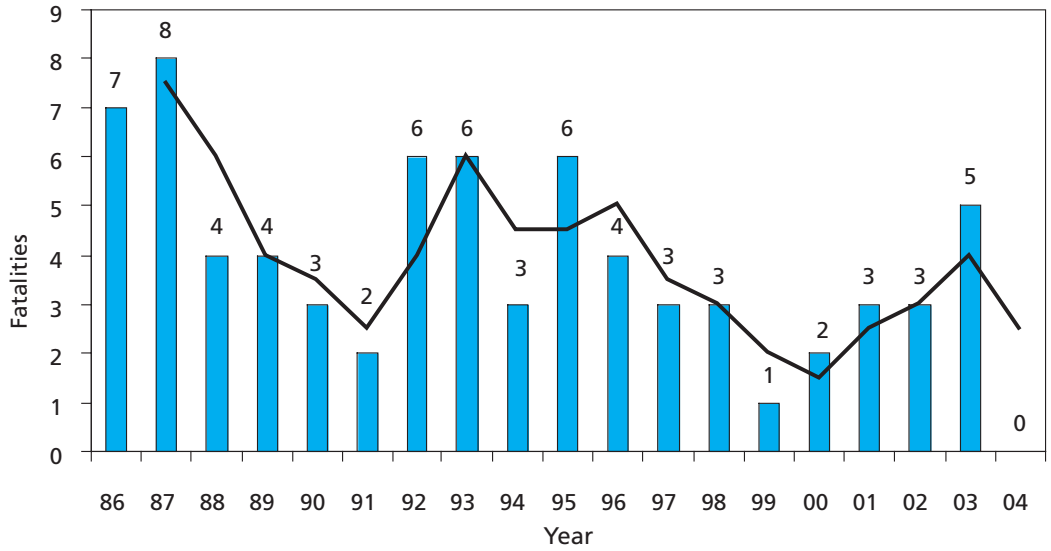

FIGURE 1 Roadway worker fatalities.

practices of the railroad industry. The committee was under pressure to report a consensus. Perhaps for these reasons, the rule's text did not clearly resolve some key matters, and several issues have arisen concerning interpretation of the rule.

The Association of American Railroads (AAR), for example, challenged a key FRA interpretation unsuccessfully in court.[1] FRA recently completed two major Technical Resolution Committee efforts—including the creation of an RSAC working group—to revise and clarify the regulation and to develop solutions for other issues of interpretation. Support for the regulation remains strong.

Locomotive Crashworthiness

In June 1997, FRA asked the RSAC to review accident data, available technology, implementation costs, and other applicable factors and make recommendations about the crashworthiness of locomotives. RSAC created a Locomotive Crashworthiness Working Group with representatives from the railroads, labor, and the two major manufacturers of locomotives, as well as FRA (see Table 3, below).

The working group broke the task into three phases. The first included an accident review to formulate the prevalent scenarios involving injuries and deaths. Second, the group drafted structural modifications for locomotives and analyzed the potential effects on the scenarios. Third, the group recommended federal regulations and industry standards for locomotive crashworthiness.

[1] *AAR v. Department of Transportation* (198F.3d944, D.C. Cir. No. 1999).

TABLE 3 RSAC Locomotive Crashworthiness Working Group Members

- American Association of State Highway and Transportation Officials
- American Public Transportation Association
- American Short Line and Regional Railroad Association
- Association of American Railroads
- Brotherhood of Locomotive Engineers and Trainmen
- Federal Railroad Administration
- International Brotherhood of Electrical Workers
- National Transportation Safety Board
- Railway Supply Institute
- Sheet Metal Workers International Association
- United Transportation Union

Scenario 1 locomotive crash near Smithfield, West Virginia, August 20, 1996—collision with a 28-car train traveling at 24 mph caused the trailing locomotive of a 41-car train traveling at 22 mph to override the leading locomotive.

Accident Scenarios

The working group discussed accidents and alternative approaches to crashworthiness at the first meeting in September 1997. The group created an Engineering Review Task Force to study accidents and to develop tradeoffs for structural modifications to locomotives.

At the request of the working group, FRA reviewed locomotive accident data from 1995 to 1996 and narrowed the pool of accidents to 23, presenting summaries to the Engineering Review Task Force. From these, five scenarios were developed: three for head-on collisions and two for oblique collisions. The scenarios are intended to encompass the range of locomotive collisions (Figures 2 and 3).

Locomotive Design

The working group asked FRA to direct a study of locomotive crashworthiness in the five collision scenarios (*5–7*). This effort used and refined train collision models that had been developed in previous studies of rail equipment crashworthiness (*8*).

Baseline levels of occupant protection were determined for the five scenarios with representative locomotive designs. Design modifications were investigated and were compared with the baseline designs (Figure 4). The results indicated that strengthened window structures, collision posts, and short hoods would increase crashworthiness for particular collision scenarios.

Design and Performance

Meeting in October 1998, in Kansas City, Missouri, the working group reviewed the modeling results. At the next four meetings, the working group debated the feasibility of alternative structural designs for locomotives, formats for specifying crashworthiness requirements, and the potential economic impact of new requirements.

Scenario 2 locomotive crash near West Eola, Illinois, January 20, 1993—the underframe of locomotive 9710 drawing 92 cars of mixed freight at 21 mph was overridden at impact by the underframe of a locomotive drawing 15 cars of automobile racks at 9 mph.

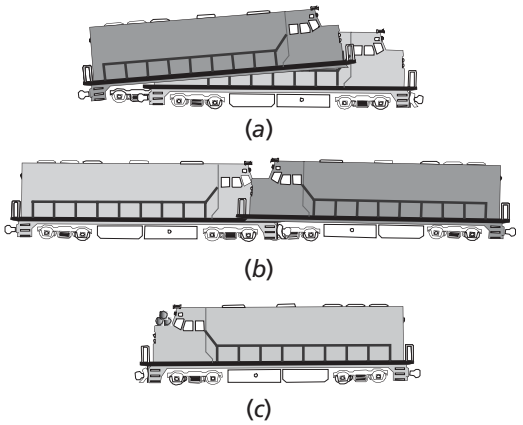

FIGURE 2 In-line or head-on collision scenarios: (*a*) Scenario 1—a trailing locomotive overrides the leading locomotive, eliminating the operator's cab; (*b*) Scenario 2—the underframe of one colliding locomotive overrides the underframe of the other, crushing the operator's cab of the overridden locomotive; (*c*) Scenario 3—the upper portion or window area of the operator's cab is destroyed.

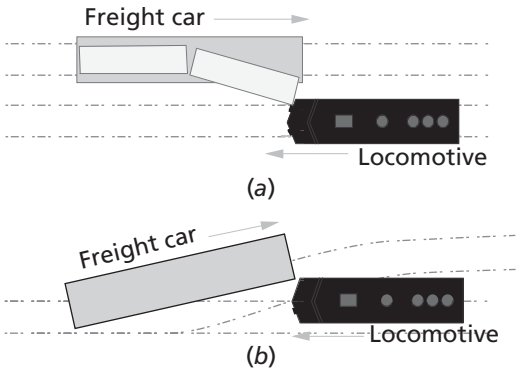

FIGURE 3 Oblique collision scenarios: (*a*) Scenario 4—an intermodal trailer fouls the right of way of an oncoming locomotive; the trailer strikes the short hood outboard of the collision post, causing damage to intrude into the operator's cab; (*b*) Scenario 5—a locomotive obliquely collides with a freight car at a switch, so that the freight car rakes down the side of the locomotive, and damage intrudes into the operator's space.

The working group considered specifying crashworthiness through design standards and performance standards:

- With design standards, static loads are applied to structural components. Compliance can be verified with closed-form calculations or nondestructive tests.
- Performance standards aim to limit impact intrusion into occupied space. Compliance typically requires mathematical simulation, destructive tests, or both. The principal advantages are fewer requirements for structural details and a closer correlation to desired performance.

The working group recommended that the AAR standards should incorporate design standards and that the FRA regulations should rely on a combination of design and performance standards. The working group endeavored to make both sets of requirements as equivalent as possible (*9*).

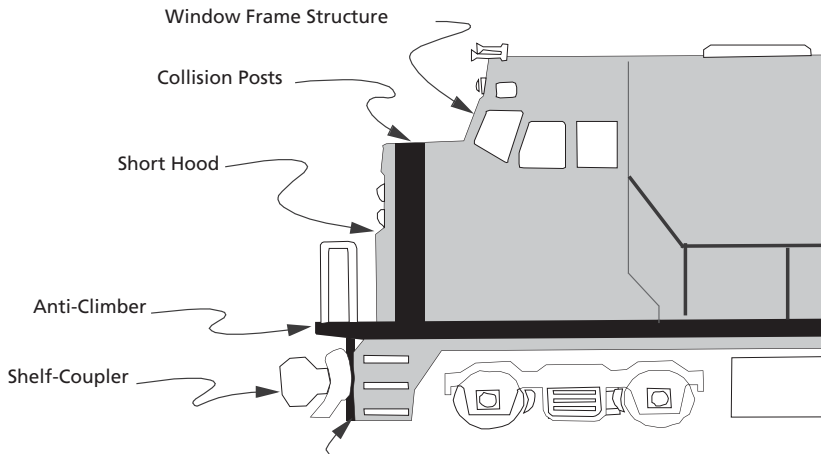

FIGURE 4 Locomotive components considered for design modification.

Expected Improvements

The Data Analysis and Benefit Assessment Task Force developed the information for a regulatory impact analysis. FRA provided the working group with an initial, favorable economic analysis, but discussion revealed disagreements about the methodology and cost assumptions, particularly for redesigning the upper portion of the cab of conventional platform locomotives. The working group therefore deferred the consideration of strength improvements in window post arrangements.

FRA's regulatory impact analysis includes qualitative discussions and quantitative measurements of costs and benefits of the recommended regulation. The analysis considered 17.4 severe injuries equivalent to one statistical life. FRA estimates that 48 statistical lives would be saved during the 19 years that benefits will accrue from the proposed rule.

The accident review revealed 286 relevant accidents with 315 casualties in 1995, 1996, and 1997. For that 3-year period, 8.7 fatalities and 96.3 severe injuries occurred per year. With the rule in place, 2.5 statistical lives would be saved per year.

The estimates, assumptions, and calculations in the regulatory impact analysis showed that the monetary benefits will exceed the costs on a yearly basis in the eighth year. For the 20-year period analyzed, the estimated quantified costs totaled $81.6 million,

and the present value of the estimated quantified costs was $43.9 million; the estimated quantified benefits totaled $125.9 million, and the present value of the estimated quantified benefits was $52.4 million. The net present value of the proposed rule was approximately $8.5 million.

Status of the Standard

The Locomotive Crashworthiness Working Group approved the recommendations for FRA regulations and the AAR standard. The RSAC then reviewed the recommendations and forwarded the proposed regulations to FRA and the proposed industry standard to AAR.

FRA drafted an NPRM, which was reviewed and approved by the Secretary of Transportation and by the Office of Management and Budget. The NPRM was published in the *Federal Register* on November 2, 2004.

The AAR Locomotive Committee is reviewing the draft standard. After receiving public comments, FRA will ask the working group to provide recommendations for finalizing the rule.

RSAC Consensus Process

Like other RSAC products, the NPRM on locomotive crashworthiness was the result of an informal negotiated rulemaking under a highly specialized process unique to FRA. The RSAC is a Federal Advisory Committee, but its substantive work is performed largely through working groups, which are not subcommittees but serve as staff to the full committee.

According to the RSAC Process document, which was negotiated with major industry stakeholders before the committee was chartered, the RSAC may accept or decline a task offered by FRA. FRA's Associate Administrator for Safety chairs the RSAC and is responsible for determining the stakeholders for a task and for appointing those organizations to the working group. Representation on each working group sets a balance between management and labor.

No recommendation may proceed to the full committee without consensus among the stakeholders. Consensus entails that all stakeholders can accept and support the recommendation, whether or not the recommendation would be the stakeholder's first choice. Any stakeholder may withhold concurrence.

Working groups are encouraged to produce recommendations in a timely fashion, but flexibility is allowed for necessary fact finding. A working group may recess while FRA contracts for the research needed to resolve underlying issues, as occurred in the Locomotive Crashworthiness task.

Salaried FRA employees, trained in interest-based bargaining and facilitation, guide the RSAC working group deliberations. These employees have experience in the railroad industry and are familiar with the nomenclature and with working and operating conditions. Although the facilitators act on behalf of the working group, they also work to achieve FRA's objectives of cost-effective, clear, and enforceable rules.

The working group forwards consensus recommendations to the RSAC, which can accept or reject the recommendations by a simple majority of the voting members. The RSAC forwards accepted recommendations to the FRA Administrator; however, the FRA Administrator is not bound by the recommendations.

Recommendations rejected by the RSAC can be returned to the working group for revision. The RSAC is not permitted to make changes in the recommendations without the consensus of the working group.

The RSAC working group for the locomotive crashworthiness task included engine and train crew members, railroad mechanical officers who order and maintain locomotives, locomotive manufacturers, a state motive power and equipment inspector, and FRA personnel—mechanical engineers, an attorney, and an economist—supported by staff at the Volpe Center. Each participant was familiar with one or more of the fatal accidents reviewed. The group also was able to build on a 1989 AAR standard and on improvements in passenger locomotive design.

Other RSAC Products

In addition to the proposed rule on locomotive crashworthiness, the RSAC has produced many other consensus products (see box, page 14) (*10*).

In only two cases in which the RSAC has failed to reach consensus has FRA found it necessary to act on its own. In one case, an RSAC working group failed to reach consensus on proposed freight power brake revisions. In the other, the RSAC failed to endorse working group recommendations on public comments about the Processor-Based Signal and Train Control Systems rule. In both cases, FRA withdrew the task and proceeded, applying best judgment in light of RSAC considerations and public comments.

In another case, the RSAC was unable to proceed to full consideration of locomotive cab temperature; FRA completed the necessary research but was unable to develop a clear case for proceeding to a proposed rule. FRA reported the research findings to the industry at an RSAC meeting, and the Federal Railroad Administrator encouraged railroads to equip and maintain locomotives with temperature control systems in areas where extreme temperatures could affect performance adversely.

Other RSAC Products

Final Rules

- Revised track safety standards, including new track–vehicle interaction standards for high-speed rail and new provisions for use of the Gage Restraint Measurement System.
- Revision of FRA's railroad communication rules, including new requirements for communications media for train crews and roadway workers.
- Revised requirements for steam locomotives.
- Revised rules for qualification and certification of locomotive engineers.
- New requirements for locomotive cab sanitation.
- Revised requirements for reporting accidents and incidents.
- New requirements for roadway maintenance machines.

Proposed Rules

- Performance Standards for Processor-Based Signal and Train Control Systems. (A final rule, fashioned outside RSAC, is now in clearance.)
- Occupational Noise Exposure of Railroad Operating Employees. (Public comments are under review.)
- Next-Generation Locomotive Event Recorders. (Public comments are under review.)

Components of Success

FRA has been developing regulations with the active participation of the rail industry and the public for more than 10 years. FRA has found that safety issues can be resolved effectively with the full participation of all affected parties, and the agency has developed many effective regulations with this approach. The efforts have helped to achieve the highest levels of safety yet for railroad operations in the United States.

The roadway worker protection regulation and the proposed rule for locomotive crashworthiness illustrate the ability of railroad industry parties to work with FRA to fashion consensus. Components of success have included

- A recognition by all parties that an issue needs to be addressed;
- Participation by an FRA interdisciplinary team that maintains negotiating instructions and provides support for the eventual RSAC product;
- Agreement on procedures before the negotiation;
- Clear focus on the details of the proposed remedy, so that all parties have the same understanding of the proposed rule;
- Flexibility to incorporate industry rules and standards into the federal regime, recognizing that one approach may not work in every situation;
- Appropriate consideration of costs and benefits;
- Follow-through by FRA to apply the results of the negotiations, consistent with the agency's regulatory purpose and legal requirements; and
- FRA's willingness to terminate the task if the group is unable or unwilling to proceed.

FRA has refrained from using the consensus process in several important areas of regulation, either because the necessary parties could not be assembled or because other agencies of government have final authority. For example, the scope of parties interested in highway–rail crossing safety issues makes assembly of an appropriate advisory committee impossible. Similarly, FRA has withheld from the RSAC issues involving alcohol and drug use and issues involving hazardous materials, which are not exclusively under the agency's jurisdiction.

FRA continues to work with labor, management, suppliers, state agencies, and other interested parties to increase railroad safety. The RSAC process has worked well, actively involving the necessary parties and informing agency decision making.

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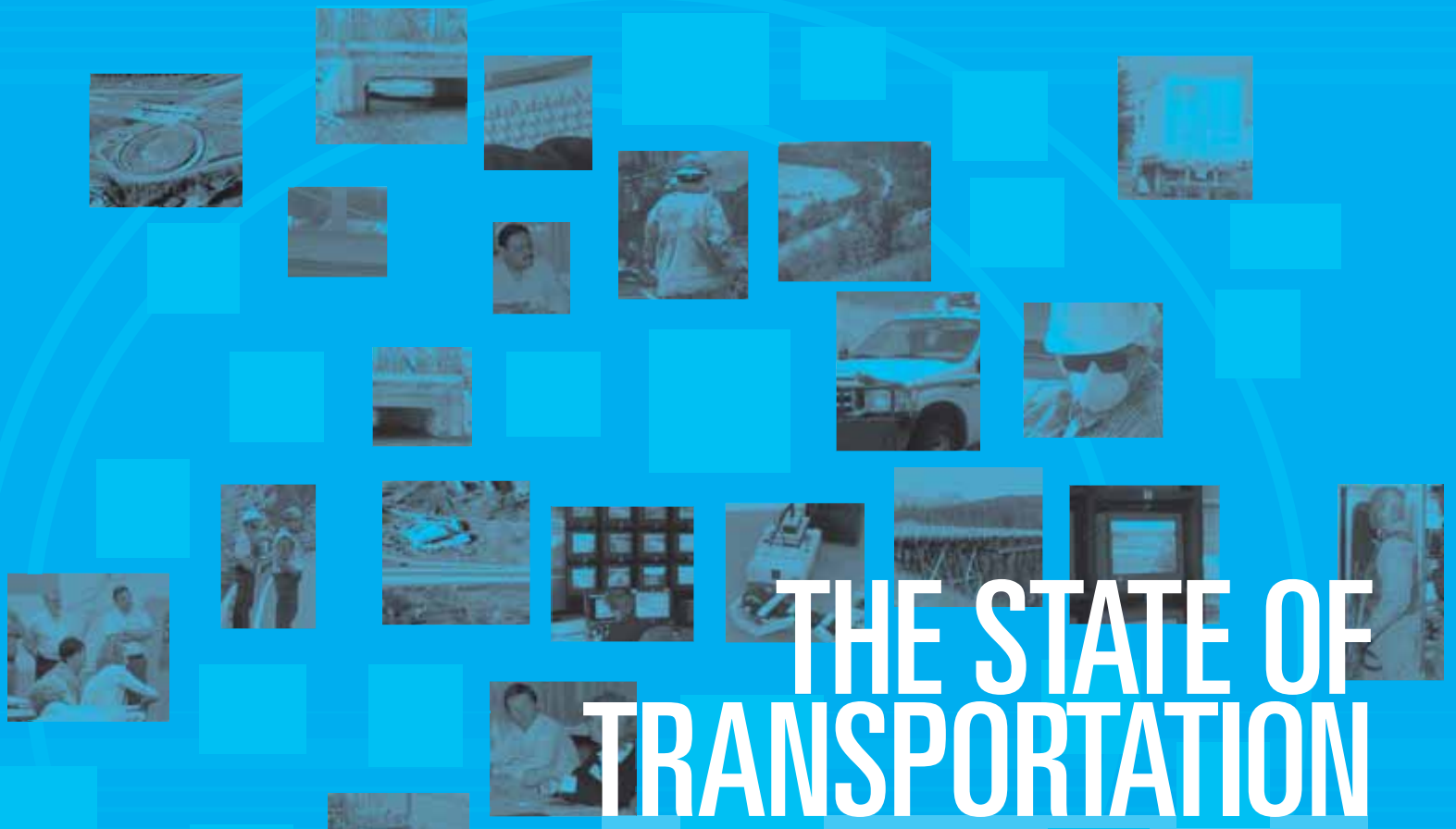

THE STATE OF TRANSPORTATION

Findings from the Transportation Research Board's 2004 Field Visit Program

pecialists in the Transportation Research Board's Technical Activities Division identify current issues, collect and generate information on the issues, and disseminate the information throughout the transportation community. The TRB Annual Meeting, TRB-sponsored conferences and workshops, standing committee meetings and communications, publications, and contact with thousands of organizations and individuals provide TRB staff with information from the public and private sectors on all modes of transportation.

A major source of this information is the annual field visit program. TRB staff members meet on site with representatives of each state department of transportation (DOT) and also with representatives of universities, transit and other modal agencies, and industry. The objectives of the field visit program are to

- Identify problems and issues of importance to the department and other organizations visited,
- Provide assistance and information to help the organization in addressing the problems and issues,
- Identify problems and issues that TRB should address to assist transportation organizations, and
- Identify activities that TRB should continue or undertake, to provide the best service to sponsors and other customers.

This report summarizes the information gleaned from the TRB staff visits. Also included are boxed reports on three areas of emphasis: performance measures, succession planning, and national parks and public lands.





Institutional Issues

Management and Leadership

The uncertainties about reauthorization of the federal-aid surface transportation program remain the biggest concern for transportation management. Failure to pass the reauthorizing legislation during 2004 may place additional pressure on funding, especially with the emphasis on reducing the federal deficit in 2005.

Nevertheless, in 2004, successful referenda at the state and local levels supported transportation-related projects. According to the American Road and Transportation Builders Association, the November ballot offered 46 such referenda in 21 states, and of those, 36 were approved, totaling more than $28 billion.[1] Initiatives in California led the nation in terms of quantity and size, but other states with notable successes included Arkansas, Colorado, Florida, Kentucky, Michigan, Rhode Island, South Carolina, and Texas. Public transit initiatives were approved in Arizona, Colorado, Florida, Missouri, Texas, Virginia, and Washington.

Calls to diversify the sources of transportation revenue continue. Many transportation and budget experts emphasize that relying mainly on the fuel tax will not create sufficient resources to support the operation and maintenance of roadways or the construction of new facilities.

One technique receiving attention is variable rate tolling on highways. Supporters point out that the increasing reliance on "just-in-time" delivery makes a compelling argument for tolls to mitigate congestion and assure reliable arrival times. Public acceptance, however, probably will require comprehensive plans incorporating variable tolls with bus rapid transit and intelligent transportation systems.

Succession planning is a necessity at state DOTs, to alleviate the impact of early buy-outs, the downsizing of middle management, and the decreasing pool of transportation professionals. Many state DOTs have reduced their research staff yet are concerned about the ability of the remaining staff to oversee research activities contracted out to private firms. The coordinated efforts of state DOTs, universities, and the private sector—for example, the newly established Missouri Transportation Institute in Rolla—may provide models of how to work effectively with limited financial and human resources.

Legal Issues

State transportation attorneys are focusing on issues of primary concern to operating and planning officials.

PHOTO: LARRY LEVINE, WMATA

Transit police officers in Washington, D.C., performed high visibility sweeps of Metro trains on Inauguration Day, January 20, 2005.

Security and environmental matters present special problems, but transportation attorneys also must deal with the basic legal problems of contract fraud and tort liability in highway construction. Following are areas of major interest:

- *Technology and the law*. High technology has become a reality in the courtroom. Attorneys must keep abreast of court requirements, and trial attorneys must be trained in the proper use of the technology. For example, land acquisitions and eminent domain actions require the storage and immediate retrieval of site data. Appraisers, acquisitions staffs, and attorneys must be able to access valuation data quickly, to be competitive with the private sector.
- *Ethics*. Attorneys are expected to alert program officials when a decision borders or crosses over into illegality or unethical conduct. This requires distinguishing who is the attorney's client—the transportation official or the public? Increasingly the courts are saying that attorneys are responsible to the courts and to the public.
- *Tort liability*. The release of safety data collected by state DOTs raises concerns about potential liability. Agencies are still struggling with the implications of the U.S. Supreme Court's January 2003 decision in *Guillen v. Pierce County*, reversing a ruling of the Washington State Supreme Court that had invalidated the Section 409 protections for state-collected data.[2] Nevertheless, state courts

[1] *Transportation Builder*, November–December 2004, p. 26. www.artba.org/artba_publications/pdf/TB_Nov_Dec_2004_Feature_2.pdf.

[2] U.S. Code, Title 23: Highways, Chapter 4: Highway Safety, Section 409: Discovery and Admission as Evidence of Certain Reports and Surveys. http://uscode.house.gov/search/criteria.php.

are reluctant to apply the protections to data that agencies have collected.

◆ *Transit*. The balance between assuring safety and security while protecting civil liberties in public transportation remains the most prominent issue for transit attorneys. Fare increases, environmental justice, and procurement practices are other topics for attention. Reauthorization of the surface transportation programs remains a major institutional concern for transit attorneys.

Planning

Transportation planners often are called on to perform the roles of community planners and economic development officers. The trend is most apparent in rural areas with local governments that have limited staff.

SPECIAL EMPHASIS AREA 1

Performance Measures

The definition and application of performance measures vary widely across the states, as do the importance and impact of programs to measure performance. Four conditions are critical for the successful implementation of performance measures:

1. The performance measures must be understandable and useful to staff and decision makers;
2. Agency staff and decision makers must work together to select and define the performance measures;
3. Top leadership must be committed to the implementation of the performance measures and must communicate the commitment effectively to all employees; and
4. The data that are gathered must be used, and employees must know how the data are being used.

In some agencies that have established performance measures but have neglected these steps, the staff is skeptical—to them, performance measures are only the latest buzzword. One state DOT, for example, assigned the performance measures of seat belt use and the number of highway fatalities to the planning staff. The planning staff, however, had no input in choosing the performance measures and had no idea of how their activities affected either measure. As a result, the staff members were skeptical about the value of the performance measures.

The Washington State DOT quarterly publication, the Gray Notebook, updates stakeholders on performance measures.

In contrast, Ohio DOT is committed to performance measures and has made clear to staff the role of performance measures in decision making. As a result, employees in all areas and at all levels of the organization have adopted the concept.

PHOTO: WASHINGTON STATE DOT

Emergency responders handle an incident on Interstate 5 in Washington State. Incident response data are published in the Gray Notebook to help identify problem segments of the highway.

The Metropolitan Transportation Commission (MTC) of the San Francisco Bay Area has been evaluating system performance from year to year. MTC uses the system performance information to publish a report highlighting key transportation issues.[1] The challenge has been to summarize and analyze the large data sets to develop reports that are useful to decision makers and the public.

According to MTC, the performance reports provide a way to "tell the story" of transportation in the region. Washington State DOT publishes the quarterly "Gray Notebook," *Measures, Markers, and Mileposts,* which updates stakeholders on key performance measures in a range of areas, including highway construction, worker safety, workforce training, incident response, delays and congestion, freight, and more.[2]

[1] www.mtc.ca.gov/datamart/.

[2] www.wsdot.wa.gov/accountability/GrayNotebook.pdf.





Recognizing that transportation projects can have a profound effect on land use and economic development, transportation planners must work with community groups and citizens to make sure that the selected transportation improvement will move the community closer to its goals. For example, Alaska DOT transportation planners frequently begin the process of roadway improvement planning by defining the community's goals.

The McCarthy Road Roundtable project demonstrates this process. McCarthy Road is one of two roads serving the enormous Wrangell–St. Elias National Park in southeastern Alaska. One goal of the Roundtable project was to determine improvements to McCarthy Road; however, the first two phases of the project focused on development issues and growth forecasts for the surrounding area (Phase I) and on establishing community goals and selecting growth management tools (Phase II). With no formal government at the local or regional level, transportation planners from Alaska DOT and the National Park Service worked with residents on these issues.

In rural areas, in declining urban centers, and in small communities, advocates for economic development often call for transportation improvements to encourage new businesses and employment. Although the connection between transportation investment and economic development is not completely understood, transportation planners often work with communities on projects with the goal of encouraging economic development.

For example, at the Appalachian Transportation Institute of Marshall University in West Virginia, transportation planners and researchers have worked to leverage transportation funds to encourage development. Their efforts range from the traditional—such as

SPECIAL EMPHASIS AREA 2

Succession Planning

Recent state visits have revealed dramatic reductions in state DOT budgets and staff; large numbers of retirements, with an accompanying loss of experience; difficulties in hiring civil engineers; and concerns about the future of state DOT operations. These problems are attributable to a variety of conditions within state DOTs:

- State salary levels are low, compared with levels in private firms.
- The advancement track for technical staff—including engineers, planners, and data staff—is not clear.
- The flattening of state DOT organizational structures has created a gap in the number of middle managers preparing for top-level positions.
- Staffs have been reduced through early buyouts or by not filling vacant positions.
- State DOTs are outsourcing work or hiring temporary employees.

Several outside factors are also contributing to these problems, starting with the decreased supply of civil engineering graduates. Civil engineers and other technical staff who recently have graduated from universities must meet an expanded set of competency demands. State DOTs need staff who can understand the impact of transportation in the environmental and social context; who can communicate with the public and decision makers; and who have

A contract operator works in the control room at the Michigan Intelligent Transportation Systems Center.

expertise in project and contract management. Retiring staff have gained these skills during their careers, but newer employees need to acquire these skills quickly.

Various states, universities, and other transportation agencies have found creative solutions to the problems of staffing. Following are some examples.

PHOTO: ROLFE BUZZELL

McCarthy Road runs through the Wrangell–St. Elias National Park in Alaska.

high technology corridors to promote business development in the southern portion of the state—to the innovative—such as an industrial park with a coal power plant that produces electricity and steam from coal mine wastes, as well as bricks from the fly ash.

The additional competencies required to conduct successful community planning and economic development are among the new demands placed on transportation planners. Transportation staffing issues were identified in the field visits as an area for special emphasis in TRB's 2005 technical activities (see the box on succession planning, page 18).

Environment

The interaction between wildlife and transportation projects has become a critical concern for transportation agencies. The protections required by the Migratory Bird Treaty Act (MBTA) of 1918 and the Endangered Species Act have affected transportation delivery, sometimes in unexpected ways. In addition, states have moved beyond protecting habitat to connecting habitat—that is, safeguarding the movement of wildlife across the landscape—and are examining

◆ Lousiana DOT has a strong cooperative program with the university engineering departments in the state. Many program participants take jobs within the DOT. Newly hired engineers enter an engineering rotation program, working in the 17 sections of the DOT during the first 30 weeks. The rotation gives engineers a broad view of the department and its areas of responsibility.

◆ Mississippi is implementing a succession planning program. The DOT identified a pool of candidates on staff who could fill leadership positions. The DOT then ascertained the skill deficiencies in the group and designed a training program to remedy the deficiencies.

◆ Many state DOTs are establishing advancement tracks for technical staff.

◆ Alaska DOT has an active program to recruit engineers from out of state.

◆ Many state DOTs are offering scholarships to civil engineering students in state universities and colleges, with the understanding that the students will work for the DOT after graduation.

◆ The Appalachian Transportation Institute at Marshall University, West Virginia, has an adopt-a-school program for elementary to high school students. The goal is to encourage students to consider a career in transportation.

◆ After losing 192 employees in an early retirement program 7 years ago, Wyoming has instituted a mentoring system—each senior administrator mentors and trains at least two employees as a potential successor.

Juan Bueno, an engineer at the Nick J. Rahall II Appalachian Transportation Institute at Marshall University, uses Legos and computers to pique the interest of elementary school children in engineering careers.

The department also has developed the WYDOT University, with a four-tier curriculum to prepare employees to advance successfully in their careers:

1. Skills assessment and orientation;
2. Changing jobs;
3. Management; and
4. Executive management.

Each Wyoming DOT employee must prepare a career development plan.

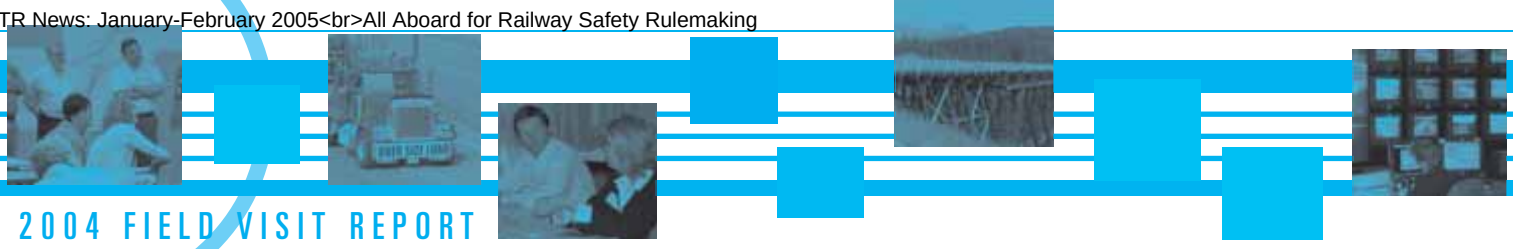

PHOTO: GRUBB PHOTO SERVICE

Southern counties in West Virginia are developing land along the I-64 technology corridor near the Raleigh County Airport and Industrial Park.

how transportation projects can improve the quality of the habitats that remain.

The MBTA was signed originally with Canada and later with Mexico, Japan, and Russia. In 2001, after a court ruled that the MBTA applied to federally funded projects, the U.S. Fish and Wildlife Service issued guidance for implementing the act. The new guidance prohibits state DOTs from disturbing active nests during roadway construction and bridge maintenance or rehabilitation.

In areas with a brief window for construction, such as Alaska and the northern-tier states, the guidance has created problems. Southern states often can apply simple techniques to clear land or to prevent nesting. For example, on bridges that are due for maintenance or rehabilitation, the California Department of Transportation (Caltrans) covers up open structural spaces in the off-season to prevent rough wing swallows from nesting. Caltrans then removes the coverings when the bridge projects are completed.

In Alaska, however, DOT workers cannot reach the right-of-way before the birds, which arrive before

SPECIAL EMPHASIS AREA 3

National Parks and Public Lands

National park transportation planners have approached transportation service and design differently from state and local transportation planners. The differences reflect National Park Service goals. National park planners often must balance the provision of transportation facilities against competing goals, for example:

- Reducing or limiting vehicle traffic.
  - Transit service was introduced in Acadia National Park, Maine, in 1999, to improve air quality and traffic congestion. The service operates from mid-June through October with 17 to 18 buses.
  - To protect the wildlife and visitor experience, the National Park Service limits the number of vehicles that may enter Denali National Park, Alaska. Buses provide tours and access to campgrounds within the park.
- Preserving the "rural" feel.
  - Many residents—even some who owned tourist businesses—objected to paving or widening McCarthy Road, which runs through Wrangell–St. Elias National Park in Alaska. They believed that the park and the communities along the road should continue to attract "adventurous or independent" travelers who value the difficulties of driving on the road.
  - New Hampshire DOT has been working with the National Park Service to identify the most appropriate material for guardrails—a material that fits the park experience, that will last as long as traditional materials, that is easy to maintain, and that provides protection to automobile drivers and passengers.
- Providing safe and affordable low-volume roads.

Bridge on McCarthy Road in Alaska preserves the rugged but environment-friendly ideals of the neighboring communities.

the snow melts and start building nests when the surrounding land is a quagmire and inaccessible to construction equipment. The requirements to avoid the nesting birds have shortened the state's already brief construction period.

States are developing creative techniques to protect wildlife. Every habitat has specific characteristics and different problems, but the transportation profession is sharing and adapting many helpful ideas and approaches. The Federal Highway Administration (FHWA) has a website, Keep It Simple, that provides a forum for sharing creative techniques, highlighting more than 100 simple, successful activities from all 50 states and from FHWA's Western Federal Lands Division.[3]

Many state DOTs are working with their resource agencies to address ecological issues as diverse as habitat connectivity, fish passage barriers, wetlands, stormwater management, transportation noise, and animal–vehicle collisions. State DOTs are trying to optimize use of limited resources to make improvements.

The design of roads, bridges, and roadside features is critical to improving transportation and wildlife interactions, but state DOTs are looking beyond, to protecting the quality of watersheds and habitats. Washington State DOT, for example, is working with the state's Department of Fish and Wildlife to inventory fish barrier locations. The DOT will prioritize the necessary improvements according to the habitat quality upstream from the barrier and the impact on watershed connectivity.

Data and Information Technologies

State Data Programs

Budget pressures require DOTs to make the best use of available data. Statewide data programs reflect industry trends by integrating a variety of data sources to perform comprehensive analyses of transportation programs. State DOTs also are striving to align their data programs with organizational priorities and to demonstrate the value of the assembled data for program delivery.

[3] www.fhwa.dot.gov/environment/wildlifeprotection.

Parks across the country require safer road designs for two-lane, low-volume roads. A particular problem is the construction of low-volume road bridges that pose no harm to wildlife.

- Managing transportation in rural areas.
  - In Wyoming, more than 50% of the land is federally owned. The state's two biggest management issues are providing transportation on demand for the elderly, with no passenger rail and with cuts in Greyhound bus services, and dealing effectively with the variations in management, maintenance, and planning from park to park.
  - State DOTs must negotiate with a variety of federal agencies on transportation issues involving the parks—for example, the National Park Service, the Fish and Wildlife Service, the Bureau of Indian Affairs, and the Bureau of Land Management.

These goals are shared by state and local transportation planners, who seek the opportunity to share experiences and lessons. The TRB Transportation Needs for National Parks and Public Lands Task Force facilitates this exchange by bringing together staff from national parks, public land agencies, state DOTs, and local agencies. The task force conducts a summer meeting, as well as workshops and sessions at the TRB Annual Meeting.

PHOTO: RICK CARPENTER, WYOMING DOT

Wyoming State DOT engineers meet with tribal representatives on issues of planning and training.

Working within Native American territories raises special issues for DOTs, because of Native American sovereignty over the lands. Some transportation officials have cited historical problems in constructing roadways through the reservations and in enforcing traffic laws.

Several states, like Wyoming, have discovered the advantage of assigning a senior staff member to foster cooperative, ongoing relationships with Native American tribes. Wyoming's senior engineer, for example, attends tribal business council meetings to discuss transportation planning and the training of tribe members in roadway construction and maintenance.

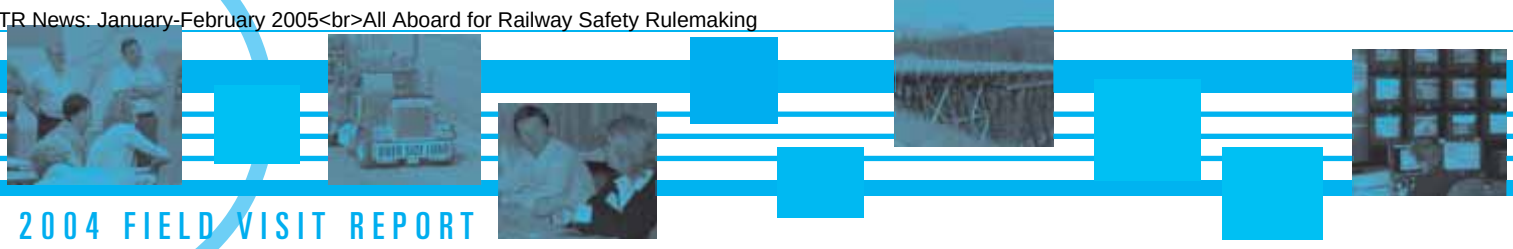

PHOTO: WASHINGTON STATE DOT

Washington State DOT has procedures to remove fish passage barriers during road construction and routine maintenance of failing culverts.

Initiatives such as transportation system performance measurement and asset management accentuate the need for data sharing and integration. Many DOT data programs are evaluating how to identify, define, and coordinate customer needs. The results have produced initiatives to integrate legacy program data and to increase the use of enterprise geographic information system (GIS)–based data systems to link programs.

Freight Data

States, metropolitan planning organizations (MPOs), and metropolitan areas face substantial challenges in obtaining and using freight transportation data that serve their needs. Agencies at these levels are looking forward to the release of the 2002 Commodity Flow Survey (CFS) data for multimodal freight activity patterns.

Because of reductions in the 2002 survey sample, however, the new CFS data may offer fewer of the geographic details that these agencies need than the 1997 version did. Some agencies will purchase private-sector freight data from companies, although the geographic detail still may be insufficient for application to the traffic and planning models.

Agencies face substantial expenses in establishing their own local or regional freight data collection programs or in undertaking data modeling and synthesis efforts to generate the geographic detail required for freight flows. Although some mode-specific data sources—for example, maritime and railroad freight data—may supply adequate detail for many intermodal planning purposes, the least data are available for trucking, which is the largest mode of freight transportation.

Urban Data

Many users are beginning analysis of data on personal travel at the metropolitan and state levels, as major national data sets become available. The 2000 decennial census data are providing geographic details that will be useful to transportation planners.

Of particular interest is the Census Transportation Planning Package (CTPP), a special tabulation paid for by states and MPOs that includes journey-to-work data. This is the only census product that contains data on workers by place of work and on flows between home and work.

Another new data source for travel patterns is the National Household Travel Survey (NHTS), a joint data collection effort by the Bureau of Transportation Statistics and FHWA. The survey provides information on all household trips. Although much of the data collection is oriented to traditional travel demand forecasting, new demands for data to evaluate policy alternatives are leading many agencies to reexamine their models and their supporting data programs.

Information Technology

State transportation information technology (IT) activities also are influenced by reductions in resources and funding. The technology priority for most state DOTs is to maintain a stable IT environment, which includes replacing old hardware—personal computers, servers, and network infrastructure—as necessary to keep required applications and business functions

PHOTO: MID-OHIO REGIONAL PLANNING COMMISSION

Agencies face high costs to collect data on multimodal freight activity patterns.

operating. Improving the security of the systems is an important function as homeland security measures require an increasing share of state DOT funding and resources for IT.

Aviation

Business, State, and General Aviation

Many in the world of business aviation are excited and intrigued by the potential of "very light jets," which could create a highly distributed system, moving away from the traditional hub-and-spoke model for air travel. A possibility once considered futuristic appears to be moving toward reality.

Airports

Security, capacity, and airport deregulation are major issues for managers and regulators of airports. Significant stresses arise between managers trying to run a competitive business and officials trying to maintain acceptable levels of security. With travel volumes up, airport capacity management once again has become a point of contention for industry and government.

Regional Airlines

Regional airlines, operating in partnership with major airlines, have done well, and code sharing remains a critical benefit. Approximately one of every four domestic passengers now travels on a regional carrier. Like the major airlines, the regionals face significant challenges with taxation, rising fuel prices, the operational and financial costs of security, airport and airspace congestion, and labor.

Major Legacy Airlines

The financial condition of the U.S. airline industry remains tenuous, despite passenger volumes returning to the levels reached before September 11, 2001. From 2001 to 2003, U.S. airlines suffered a net loss of $23.2 billion. The industry has responded aggressively, with such strategies as workforce reductions, modified work rules and benefits, revised procurement policies and procedures, fleet simplification plans, deferred capital expenditures, streamlined distribution channels, and the deployment of new technologies. New business models are emerging but the final outcome has yet to be determined.

Freight Systems

Awareness of the importance of freight transportation to the local, state, and national economies is growing among state DOTs. The scope of issues related to freight transportation, however, frequently extends beyond state boundaries to multistate corridors and to global trade movements. All freight modes are under stress; the challenge for state DOTs is to identify their role in improving freight flows on state owned and operated facilities and through connections with private facilities.

PHOTO: ATLANTIC SOUTHEAST AIRLINES, INC.

Regional jet (CRJ-700) in operation at Hartsfield-Jackson Atlanta International Airport.

Key Issues

Key issues in freight transportation that emerged during the field visits include the following:

- *Understanding freight*. Significant education is necessary for many public-sector planners and decision-makers to understand that the demand for freight transportation derives from complex decision making by private-sector shippers, carriers, and logistics providers. States with seaports that funnel large volumes of foreign trade have more visible local issues, such as traffic congestion, which demonstrate the impacts of freight. Southeastern states have been studying trends in Latin American trade and the implications for their transportation systems as trade volumes grow.
- *Role of the public sector in freight transportation*. Educating the general public about freight also is necessary, because public investments in freight-related transportation improvements frequently benefit private companies as well as the public. Several freight studies are developing analytical tools to support public policy.
- *Planning*. Most states recognize that freight is a critical element in transportation planning. Minnesota is developing its first statewide freight plan. Florida has drafted a plan for a strategic intermodal system that will improve mobility for freight and travelers.
- *Data*. Successful planning depends on reliable data. Sources of freight transportation data to





support statewide and metropolitan freight planning are limited.

◆ *Prioritizing freight projects*. With an array of public and private beneficiaries, freight projects are difficult to prioritize through traditional planning and programming.

◆ *Funding freight projects*. State DOTs must contend with state and federal restrictions on the use of dedicated highway funds for multimodal freight projects. Increased emphasis on freight projects is expected in the next federal highway reauthorization act.

◆ *Performance measures*. Many states that are investing in freight projects list performance measures as a critical need.

Trucking

In most states, the goals of incorporating trucking issues into planning and of defining a public role in facilitating freight movement are evolving. State DOT concerns about trucks include the effects on pavement deterioration, the impacts on structures and on air quality, and the need for new tools for size and weight enforcement. Several states, including Virginia and Florida, are looking at alternatives such as truck-only lanes, but funding the construction and operation of truck-only facilities is a major issue.

Many states are using new technologies to improve enforcement activities and to lower costs. The industry favors many of these innovations—such as moving the permit process for oversize and overweight vehicles online, which improves efficiency for truckers and for the DOTs. The concept of virtual weigh stations is gaining attention with the prospect of using wireless technology to transmit weigh-in-motion data, as well as photographs of the vehicles.

PHOTO: DIAMOND HEAVY HAUL

Online permit process for oversize and overweight vehicles has improved efficiency for truckers in many states.

Highways

Design

An aging infrastructure and a heightened public awareness of the importance of a reliable and safe transportation system are creating more demand for the redesign of roadways and the rehabilitation of pavements and bridges with innovative materials and techniques that improve performance and efficiency.

Many states are relying on contractors to complete highway designs. The contracts are necessitated by reductions in state work forces in the past several years and by an increase in design output to keep pace with construction programs.

Context-sensitive design has evolved into context-sensitive solutions and is attracting the attention of the public, designers, traffic operations personnel, and other practitioners. Many states are developing best practices for effective public involvement and are sharing case histories to facilitate the process.

States are applying technological advances in the collection and analysis of pavement condition data, using infrared and laser equipment, digital video, and enhanced computer software. As a result, refined data are input into pavement management systems, and projects and resources can be prioritized more accurately.

Many states are previewing the new *AASHTO Pavement Design Guide,* distributed on CD-ROM, and are developing plans for implementation, including calibration and training efforts. The states are looking to the National Cooperative Highway Research Program (NCHRP) for additional information and assistance on the next steps.

The load and resistance factor design (LRFD) method for bridges and other structures has gained in use significantly as the 2007 implementation deadline approaches. The level of adoption varies among the states, and many are investigating the calibration and substructure aspects before full implementation. The pressure to get projects into construction has limited the time for training design engineers in the new method.

States are using innovative materials—for example, high-performance concrete and structural fiber-reinforced plastics—as well as innovative design and construction techniques, to build structures more efficiently and with greater durability. These innovations will help reduce work zone construction periods and maintenance activities in travel lanes.

Materials and Construction

Most states are calling on consultants for construction

Tennessee is among the states to organize Accelerated Construction Technology Transfer workshops, which elicit the advice of experts before major improvement projects.

engineering and inspection, because of increased workloads and diminished in-house work forces. One state with a major new program involving intelligent transportation systems (ITS) expects to increase reliance on consultants for inspection expertise not available in-house. At least one state may require consultants for materials lab testing after an increase in its construction program. States are concerned about the lack of experience and training in their own reduced work forces, as well as among consultants and contractors.

Most state DOTs are focusing on infrastructure renewal, congestion relief, and safety improvements, and the traveling public expects this work to be performed with minimal inconvenience. As a result, state DOTs must fast-track construction without compromising project quality or safety and are trying out a variety of methods and procedures.

Several states have convened Accelerated Construction Technology Transfer workshops, conducted by FHWA and the American Association of State Highway and Transportation Officials (AASHTO), to assist with major improvement projects. Design–build and cost-plus-time contracting are used routinely in some states. A few states have installed prefabricated items, particularly on bridges, and at least one state is trying out prefabricated concrete slabs for pavements.

Most states are experimenting with self-consolidating concrete in structural members and deep shaft foundations. At least one state has applied roller-compacted concrete on the shoulders of a major highway. Recycling remains a viable strategy, and many states are allowing recycled materials for their projects as long as the engineering, environmental, and economic conditions are conducive.

Common construction and material issues among the states include smooth and quiet pavements, permeability and moisture sensitivity of asphalt pavements, segregation and compaction of asphalt pavements, and early bridge deck cracking.

Geotechnical Engineering

Several states are developing geotechnical database management systems. The objective is easy and timely access to an inventory of laboratory and field test results, integrating information stored in various formats and locations.

Some states with rock-fall problems have pooled their resources, with Washington State DOT in the lead, to establish practical guidelines for wire-mesh drapes to mitigate debris from rock falls. A pooled-fund study led by Oregon DOT has developed guidelines for the design of rock-fall catchment areas; the guidelines are being disseminated through workshops and presentations at regional and state geotechnical engineering conferences. Another pooled-fund study, with Caltrans in the lead, is investigating techniques for ground improvement.

Several state DOTs are interested in a new procedure, developed under an NCHRP project, for nondestructive testing to evaluate the condition of metal reinforcements in mechanically stabilized earth walls.[4] Most of these geotechnical structures are now approaching 20 or more years of service life, and states

[4] NCHRP Project 24-13, Evaluation of Metal-Tensioned Systems in Geotechnical Applications. See NCHRP Report 477, Recommended Practice for an Evaluation of Metal-Tensioned Systems in Geotechnical Applications (2002), http://gulliver.trb.org/publications/nchrp/nchrp_rpt_477.pdf.

PHOTO: TEXAS DOT

Recycling concrete near Houston for a Texas DOT highway project.





Caltrans engineers perform a slide stabilization project on US-199 near the Oregon border.

are interested in ways to determine the condition of the metal reinforcements and the remaining service life.

Subsurface voids—sink holes, karst topography, and abandoned underground mines—continue to cause problems along transportation corridors. States are sharing information on successes and failures in the identification and mitigation of hazards from subsurface voids. The application of geophysical techniques has attracted attention—notably resistivity techniques, electromagnetic techniques, gravity techniques, seismic reflection and refraction, and ground penetrating radar.

Maintenance

The transportation infrastructure is aging; the numbers of employees and the financial resources are dwindling; and maintenance activities must expand in response to safety and environmental issues. The maintenance community is addressing these challenges through the application of preservation concepts, the development of private-sector partnerships, the training of employees, and the introduction of new materials, technologies, and procedures.

PHOTO: NATIONAL CENTER FOR PAVEMENT PRESERVATION

Microsurfacing is one of many pavement preservation techniques that states are integrating into a plan of preventive maintenance, rehabilitation, and reconstruction.

Maintenance preservation includes a variety of activities that affect the daily operations of the transportation network—such as removing snow and ice during winter storms, maintaining traffic control systems, patching potholes, and responding to emergency incidents—as well as activities that affect the availability of the infrastructure—such as maintaining pavements, bridges, roadsides, rest areas, and equipment. Most of these activities have high customer visibility and therefore are the subject of efforts to improve quality, efficiency, and effectiveness.

To preserve the safe operation of the transportation system during winter storms, agencies are adopting a proactive total storm management (TSM) approach as part of a maintenance decision support system to coordinate the response of the state work force and contractors to changing storm and traffic characteristics. TSM technologies and activities include road weather information systems, automated vehicle location on snowplows, salt retention and frost forecast models, road condition information for the public via the Internet and at rest areas, and fixed automated spray technologies for anti-icing on bridges. The improved TSM procedures, materials, and equipment can save lives, property, and expense, with minimal effects on the environment.

Another area of change is the development and implementation of appropriate traffic control measures in work zones to ensure the safety of the traveling public and roadway workers. FHWA's Final Rule on Work Zone Safety and Mobility applies a holistic approach to improve safety, starting with project planning and continuing through design, implementation, and performance evaluation.[5]

Preservation of the physical infrastructure requires expertise in management, engineering, and economics; the establishment of strategic performance goals; and the implementation of routine and preventive maintenance and minor rehabilitation activities. States are finding that a three-pronged approach of preventive maintenance, rehabilitation, and reconstruction can improve network condition, optimize available funds, and balance the remaining service life of the network features.

Accomplishing these objectives, however, requires agencies to deal effectively with issues of finance, planning, design, construction, preservation, and monitoring the condition of network elements. Agencies are coordinating these proactive efforts through new

[5] http://ops.fhwa.dot.gov/wz/resources/final_rule.htm.

maintenance management systems that incorporate asset management concepts and that respond to infrastructure needs.

Highway Operations

Highway congestion occurs daily in all large metropolitan areas in the United States—a constant source of frustration and agitation for drivers and a threat to mobility and the nation's economic vitality. The Texas Transportation Institute's *2004 Urban Mobility Report* estimated that the cost of congestion in 85 of the nation's large urban areas in 2002 was $63.2 billion.[6] TTI's study also estimated that delays consumed more than 3.5 billion hours and more than 5.7 billion gallons of fuel.

Congestion occurs when traffic demand exceeds available capacity. Causes of recurring congestion include insufficient road capacity and ineffective management of capacity—for example, poor signal timing. Causes of nonrecurring congestion include work zones, incidents, weather, special events, and emergencies.

Historically, the solution to recurring congestion has been to construct new highways or to widen highways to increase system capacity. Expansion of capacity, however, has become difficult because of insufficient funding, lack of available rights-of-way, and environmental concerns.

State DOTs therefore are turning to improvements in systems management and operations (M&O) to reduce recurring congestion. Improving M&O is a cost-effective solution to reduce delays and improve travel-time reliability. According to FHWA, improving M&O can increase regional systemwide capacity by 10 to 20 percent.

M&O includes the implementation of technological remedies—such as ITS—and operational improvements in such areas as

- Freeway and arterial operations—for example, adaptive or advanced traffic signal systems, emergency and transit vehicle preemption, and ramp metering;
- Traffic incident management—for example, incident detection and response plans, quick clearance and "Move It" programs, motorist helper fleets, and dynamic message signs;
- Emergency management;
- Work zone traffic management;
- Traveler information services, including 511;
- Weather event response;

[6] http://mobility.tamu.edu/ums/report/.

Incident management techniques have been a focus for states working to reduce nonrecurring congestion.

- Special events management;
- Electronic payment services; and
- Parking management systems.

The successes of state M&O programs can be replicated. A key lesson, however, is that states must overcome a parochial adherence to jurisdictional boundaries and develop a regional perspective. Although technology solutions are critical to the operation of systems and to the mitigation of congestion, addressing the problems regionally is the key to a successful program, because congestion has no boundaries.

Safety

State DOTs are implementing the AASHTO Strategic Highway Safety Plan to reduce deaths on the highway to a rate of 1.0 per 100 million vehicle miles by 2008. NCHRP has published guidebooks for 13 of the 22 strategies in the Report 500 series.[7] Volumes 7 through

[7] http://trb.org/news/blurb_browse.asp?id=2; scroll to titles in 500 series.

PHOTO: KENTUCKY ISMP

Officers run the Kentucky DOT Drive Smart Traffic Safety Checkpoint Trailer near a major state highway.

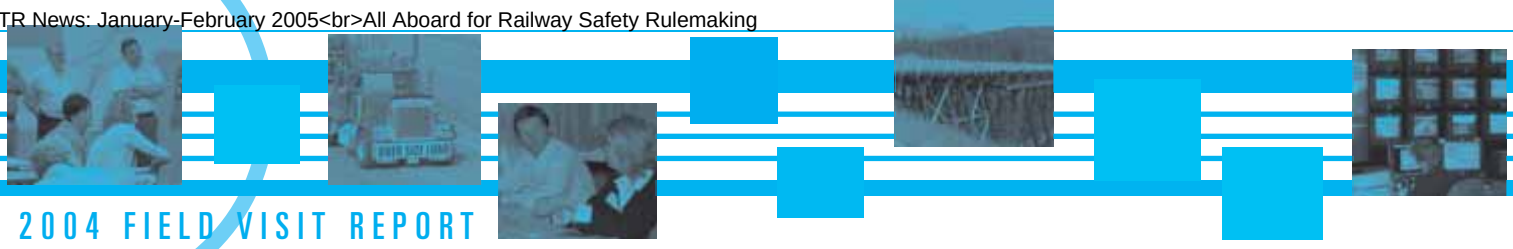

PHOTO: KENTUCKY ISMP

State safety plans include outreaches specifically for school children.

13, released in 2004, cover collisions involving older drivers; seatbelt use; collisions involving heavy trucks; collisions involving pedestrians; collisions involving utility poles; collisions at signalized intersections; and collisions on horizontal curves. The remaining guidebooks will be published in 2005.

Effective application of the guidebooks requires a procedure for identifying safety problems within the state and coordinating the various agencies and organizations that address these problems. NCHRP Report 501, *Integrated Safety Management Process (ISMP)*, describes strategies that states can adopt or adapt to cut the rates of death and injury on our roadways more comprehensively and effectively.[8] More than 30 states have volunteered to take the lead in demonstrating the safety plan guidebooks or in pilot-testing the ISMP.

A fall meeting convened representatives from 47 states to discuss the development of comprehensive safety plans (CSP) within each state. States are taking different approaches:

- Missouri has developed an overall state CSP, working with the Missouri Safety Center. State regions—often called districts in other states—along with MPOs and regional councils, are using the state CSP to develop plans to address local safety issues.
- Washington State is developing a new long-range transportation plan, with safety plans as an integral element.
- Montana is working with a consulting firm to develop a CSP.

Although the three approaches differ, all are coordinating within and across agencies; all are comprehensively considering engineering, education, enforcement, and emergency medical services; and all are data driven and goal directed.

Safety-conscious planning (SCP) continues to develop in response to a requirement in the Transportation Equity Act for the 21st Century (TEA-21). By the end of 2004, 18 states had organized SCP forums; seven additional forums are planned for 2005. These forums bring together the diverse partners working in highway and transit safety and transportation planning to learn about each other's activities, discuss data and resources, and create an action plan to include safety as a decision factor in the transportation planning process. The third SCP conference was held in the summer of 2004, allowing states involved with SCP and the forum process to exchange ideas and experiences and to learn about tools that will be available in 2005.

Marine and Intermodal Transportation

Ports and Waterways

Security was a major focus for ports and inland waterways in 2004. Port security grant funding has fallen far short of what is needed to comply with the port security requirements in the Maritime Transportation Security Act.

As a result, in the Gulf of Mexico region, nearly all ports are charging port security fees to help cover unfunded federal mandates for security enhancements. Ports in other coastal regions—such as those under the South Carolina State Ports Authority—also have implemented port security fees.

In addition, ports face environmental challenges, particularly in air quality. Various solutions are being implemented, such as enabling ships to plug into electric power instead of idling their diesel engines in dock.

Freight crosses modes at the Port of Honolulu.

[8] http://trb.org/publications/nchrp/nchrp_rpt_501.pdf.

PHOTO: KENNETH NEWHAMS, DULUTH SHIPPING NEWS

The Gibraltar-flagged *Ostkap* departs from the Port of Duluth-Superior in December 2004. The introduction of nonnative species by oceangoing vessels is a particular environmental concern.

Congestion and delays remain a challenge for major U.S. ports. In Southern California, the intermodal rail network is overloaded, and trucks must wait in line for access to the terminals. Possible measures include charging a fee for daytime pickups and deliveries and extending gate hours.

More all-water services are developing, particularly in the Asia–U.S. East Coast markets. Short sea shipping may be a solution to landside congestion in the United States; some operations are successfully under way or are in development along the East and Gulf Coasts.

The inland waterways sector awaits approval and funding for major infrastructure improvements, as debate continues over commodity forecasts and market demand. On the Great Lakes, environmental issues are critical, particularly the introduction of nonindigenous invasive species from foreign vessels.

Container-on-barge services have been implemented to help relieve highway congestion. For example, the Port Authority of New York and New Jersey (PANYNJ) has introduced ExpressBarge, a weekly service to and from Albany. Funds for the service come from PANYNJ and from air quality funds distributed through MPOs in the region.

Ferry Transportation

Ferry transportation received considerable attention this past year, with new and proposed services, plus developments affecting security, safety, and the environment. Hawaii is weighing a proposal for a high-speed ferry service linking Oahu to Maui and the Big Island, carrying passengers, vehicles, and freight on what has been called Hawaii's Interisland Highway. Private investors are looking to the state to provide the funding to modify and improve port facilities to accommodate the stern-loading, 340-foot catamaran ferry vessels.

The Cape May–Lewes Ferry between New Jersey and Delaware was selected for a pilot project, Secure Automobile Inspection Lanes (SAIL). An initiative of the Transportation Security Administration, SAIL uses a van equipped with a Z Backscatter—an X-ray imaging device—to screen cars and trucks before they board the ferry. On the environmental front, Washington State Ferries has adopted various clean fuel initiatives to reduce the amount of pollutants released in emissions and improve air quality.

Rail

Major concerns among states about railroad transportation include the future of Amtrak; the future of improved conventional and new high-speed passenger services; the potential for federal investment in passenger rail; maintaining or increasing rail's share of freight movement; understanding the public benefits of freight rail investments; and identifying and creating funding sources for rail projects.

Many states see intercity passenger rail as a critical element in relieving demand on more congested modes. Approximately one-quarter of the states financially support the passenger services provided by Amtrak.

The debate about federal funding for Amtrak is perennial. In responding to demands for passenger service, Amtrak's greatest need is for capital funding, particularly for long-deferred projects.

In addition, approximately two-thirds of the states, singly or in corridor groups, are planning and investing state funds in improved conventional and incremental high-speed passenger services. For example, California has made substantial investments for incre-

PHOTO: BRIAN LOMBARD, NEW HAMPSHIRE DOT

New Hampshire's dedicated rail fund allows track improvements on the state-owned Mountain Division rail line.

PHOTO: DETROIT–WINDSOR TRUCK FERRY

Detroit–Windsor truck ferries provide a way to reduce congestion at U.S.–Canadian border.





mental high-speed rail in several heavily traveled corridors. North Carolina has invested in improvements to rail services within the state and is working with Virginia, South Carolina, and Georgia on the development of the federally designated Southeast High-Speed Rail Corridor.

Several states are investigating whether rail freight can reduce highway congestion. The Virginia Department of Rail and Public Transportation undertook a corridor marketing study to examine the potential for diverting highway traffic from I-81 to rail intermodal movement. The study found that public investment in rail intermodal infrastructure could relieve highway needs and could provide more relief through a multistate corridorwide program.

The Virginia study also identified the public benefits—such as reduced road congestion—from an investment in rail infrastructure. Similarly, the Chicago Region Environmental and Transportation Efficiency (CREATE) Program, proposed by the rail industry, has identified public and private benefits from improvements to major rail corridors. Funding sources for CREATE's public-private partnership are still being developed.

Many states have worked to identify and combine sources of funds for rail projects. Most states are prohibited from spending gas-tax funds on rail. Some states have converted loan repayments from previous federal grant funds into state loan or grant matching programs. Other states use bonding or capital budgeting for rail projects. New Hampshire combines several sources into a dedicated rail fund to purchase materials for track improvements on state-owned lines.

Public Transportation

The prevailing trends in public transportation continued into 2004, punctuated by several special situations:

◆ On the positive side, transit agencies updated their equipment, technology, and operating practices. Ridership grew, but bus fleet size remained stable. Interest in bus rapid transit, light rail transit, and diesel multiple units—that is, self-powered passenger rail—also grew. Progress was made in improving security procedures and systems.

◆ On the negative side, fiscal pressures were relentless. Without reauthorization of TEA-21, federal funding was month-to-month. Some jurisdictions with older systems experienced malfunctions, breakdowns, and accidents. As the "baby boom" population group ages, transit ridership special needs are on the rise, particularly in rural areas.

PHOTO: OATS, INC.

Special needs of the elderly and rural residents have increased demand for transportation services, like those offered by OATS, Inc., in Missouri.

The national, state, and local elections in November 2004 seemed to indicate a renaissance in local transportation funding. Voters approved 22 fiscal measures of the 28 on the ballots nationwide involving transit.[9]

Congestion was cited as a primary reason for voter support. Denver approved a $4.7 billion program for light rail transit, commuter rail, bus rapid transit, and park-and-ride facilities. Phoenix approved a $16 billion program to extend the freeway, bus, and LRT systems. San Diego approved a $14 billion regional program for highway, transit, local roads, bicycle, pedestrian, and neighborhood safety. Similar positive results issued from many smaller cities.

Several special situations challenged transit in 2004. Transit agencies in Boston and New York City prepared for security, demonstrations, and changes in service configurations for the Democratic and Republican Conventions, respectively. In Florida and nearby states, five hurricanes disrupted the lives—and transportation—of millions. Lastly, medical researchers concluded that traffic congestion stress correlates with cardiovascular problems.

[9] www.cfte.org/success/2004BallotMeasures.asp.

TRB SPECIAL REPORT

Development and Deployment of Standards for Intelligent Transportation Systems

Review of the Federal Program

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Acting under the authority of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and the Transportation Equity Act for the 21st Century (TEA-21), the U.S. Department of Transportation (DOT) has pursued initiatives to

- Encourage the adoption of intelligent transportation systems (ITS) technology in domestic applications, and
- Support the competitiveness of U.S. ITS providers in international markets.

These initiatives include promoting the development and adoption of technical standards to specify the operating characteristics of ITS components and subsystems.

PHOTO: DAKTRONICS INC.

The National Transportation Communications for ITS Protocol (NCTIP) for Dynamic Message Signs was among the applications areas discussed by the study committee. Above, an NCTIP-compliant variable message sign near Sioux Falls, South Dakota.

In 1996, U.S. DOT established an ITS Standards Program administered by the Joint Program Office (JPO). Annual budget allocations for standards-related activities under the program have totaled $7 to $10 million.

Many activities have relied on an institutional framework provided by standards development organizations (SDOs), including the American Association of State Highway and Transportation Officials, the Institute of Transportation Engineers, the American Public Transportation Association, the Institute of Electrical and Electronics Engineers, and the Society of Automotive Engineers. U.S. DOT provides funds to support the work of the volunteer committees that devise the standards.

Evaluating the Strategy

In 1999, JPO asked the Transportation Research Board (TRB) to conduct a review of the ITS Standards Program and to evaluate the program's strategy for introducing standards. Under the auspices of the National Academies, TRB assembled a committee to review the program and published the findings and recommendations in *Standards for Intelligent Transportation Systems: Review of the Federal Program* (*1*), which served as Phase I of a two-phase study.

TRB subsequently formed a new committee for Phase II, drawn largely from members of the Phase I committee, with expertise in standards development and public policy, highway and traffic management, transit operations and management, automotive tech-

TRB Special Report 280, Development and Deployment of Standards for Intelligent Transportation Systems: Review of the Federal Program, *is available from TRB (view the book online at, www.TRB.org/publications/sr/sr280.pdf).*

nology, and systems engineering and safety (see box, below). The committee presented interim findings and recommendations in four letter reports.[1] TRB Special Report 280, *Development and Deployment of Standards for Intelligent Transportation Systems: Review of the Federal Program,* presents the final outcome of the committee's deliberations.

Phase II focused on the obstacles to effective standards deployment and how to overcome the obstacles. Emerging obstacles include

- Balancing the interests of purchasers and suppliers of ITS equipment while enhancing the public benefits from investments in the technology,
- Ensuring that federally supported standards are widely used in practice, and
- Ensuring appropriate interoperability within and among ITS installations.

After review, the committee concluded that the objectives of the ITS Standards Program have been appropriate, the overall strategy has been reasonable, and the execution has made credible contributions to achieving the congressional mandates in ISTEA and TEA-21. Despite the substantial progress, ITS development and deployment are still in an early stage. The committee recommended several improvements to enhance the effectiveness of the ITS Standards Program.

Committee for Review of the U.S. Department of Transportation's Intelligent Transportation Systems Standards Program

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Jules A. Bellisio, Telemediators, LLC
A. Ray Chamberlain, Parsons Brinckerhoff
Irwin Dorros, NAE, Independent consultant
William F. Johnson, Independent consultant
Samuel Krislov, University of Minnesota, Minneapolis–St. Paul
Alexander Lopez, Metropolitan Transit Authority of Harris County, Texas
James R. Robinson, Virginia Department of Transportation
Steven E. Shladover, University of California, Berkeley
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Setting Priorities

Although effective standards may develop without government support, the committee assumed that continued federal support would be necessary for such activities as travel by public-sector professionals to meetings of SDO committees. To determine which standards and deployment activities should have priority for government support, the committee reflected on the characteristics and sources of standards that ultimately would be effective in directing the deployment of ITS technologies.

The committee identified three primary criteria for judging the likely effectiveness of federal support:

- Goal consistency—does the standard contribute to the implementation of specific services within the framework of the National ITS Architecture?
- Role consistency—is federal support for the development of a particular standard appropriate?
- Efficiency—how do the costs of developing and deploying a standard compare with the potential benefits or losses from not having an effective standard in place during implementation?

Recommendations

The committee recognized that implementing the various suggestions would require funds and professional resources that may exceed the budget for the standards program and offered the following recommendations:

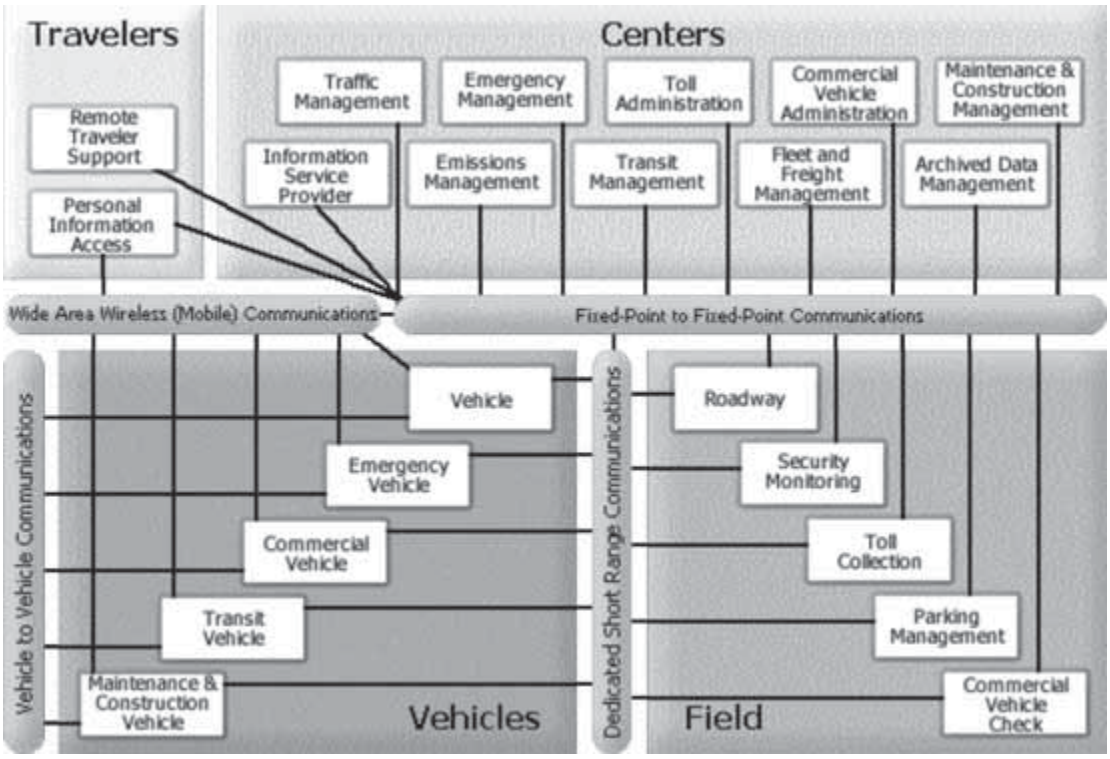
Investing Resources

- JPO should invest resources in standards development and deployment after a clearly delineated assessment of (a) how the standard would enable deployment of important ITS services and (b) the national benefits that would be gained by accelerating promulgation of the standard. The potential for contributing to interoperability on the national scale is a key indicator of benefits; however, contributing to safety, security, technological leadership, international trade, and other valid federal concerns also may justify federal support.
- JPO should develop outcome-oriented measures of effectiveness for the ITS Standards Program and should make clear that the use of standards translates into a substantial return on the public's investment.

Guiding Development

- JPO and the standards developers it supports should adhere strictly to the following stages in standards development:

[1] www.TRB.org/onlinepubs.nsf/web/reports?OpenDocument.



Schematic view of National ITS Architecture, Version 5.0. (Source: itsarch.iteris.com/itsarch/html/entity/paents_b.htm.)

1. *Testing*. Tests must ensure that the proposed standard is useful in field applications and will perform as expected. The testing should be completed before a proposed standard is submitted for balloting and adoption under SDO procedures.

2. *Formal adoption*. Balloting or another unambiguous mechanism should identify a standard as ready for use in practice.

3. *Assessment of readiness for deployment*. JPO should consider the number of applications expected in 3 to 5 years, the numbers of manufacturers and system integrators capable of installations that meet the standard, and the availability of information and materials to facilitate application of the standard, such as sample specifications, documentation, and training programs.

4. *Post-adoption support*. Training and maintenance, for example, should be pursued only after a standard has passed through the stages of formal adoption and assessment of readiness for deployment.

◆ Rulemaking should be used sparingly or not at all for ITS standards; rulemaking may be justifiable, however, for ITS standards supporting safety and security.

Looking to the Long Term

◆ JPO should support a range of activities to make standards development and deployment effective in the long term, including

– Research and development;

– Testing and demonstration to validate and assure usability of standards;

– Establishment of a national, independent verification and validation capability by the stakeholder community;

– Training for standards users; and

– Maintenance of the standards that have been developed with federal support.

◆ JPO should streamline the process for developing and revising standards.

◆ U.S. DOT should consider judicious expansion of the ITS Standards Program to include services that span the interface between in-vehicle and roadside infrastructure subsystems that are consistent with

– The program's goals;

– The role of government as a stakeholder in advancing ITS technology; and

– Efficient investment of government resources to achieve public purposes, particularly the national interoperability of ITS.

Reference

1. *Standards for Intelligent Transportation Systems: Review of the Federal Program*. TRB, National Research Council, Washington, D.C., 2000. http://gulliver.trb.org/publications/reports/its_standards_review.pdf.

RESEARCH PAYS OFF

Nighttime Construction

Developing a Specification for Road Work at Night

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More and more states are scheduling construction work at night because of high traffic volumes during the day. Nighttime work, however, has its own hazards. A comprehensive specification can help in adapting to the special circumstances of working at night.

Problem

In 2002, the Nova Scotia Department of Transportation and Public Works (NSTPW) had to repave about 8 kilometers of Highway 125—a two-way, two-lane highway that serves as the main arterial route connecting several communities. In summer, the average daily traffic regularly exceeds 25,000 vehicles, with hourly peaks of more than 2,300 vehicles. The highway is close to reaching its capacity.

Detours were not practical, because the alternative routes also were almost at capacity during the day. The repaving therefore had to be carried out during nighttime hours when traffic volumes were low, to avoid traffic delays and queues that would be unacceptable to highway users.

NSTPW occasionally had performed highway construction work at night but had developed few specific safety requirements. Because Highway 125 would be the first major paving project requiring all work to be done at night, NSTPW decided to develop a specification to address the special concerns of working at night. The measure also would respond to the requirement for due diligence under Nova Scotia's Occupational Health and Safety Act.

Nighttime paving operation on Highway 125, Nova Scotia, in 2003.

Solution

To develop the specification, NSTPW staff relied on published findings from two recently completed National Cooperative Highway Research Program (NCHRP) projects:

- NCHRP Report 476, *Guidelines for Design and Operation of Nighttime Traffic Control for Highway Maintenance and Construction*, which was a source of practical advice on traffic control devices, safety features, and the operation of a nighttime traffic control system;[1] and
- NCHRP Report 498, *Illumination Guidelines for Nighttime Highway Work*, which described the three levels of illumination recommended for nighttime construction.[2]

NSTPW also obtained comments and specifications from many state and provincial departments of transportation (DOTs) in the United States and Canada that had experience with nighttime construction.

In the past 2½ years, NSTPW has continued to update the specification from experience and onsite observations. For example, a minimum level of point illumination recently was added to the lighting requirements to reduce the variability of illumination in the work area.

The specification addresses several areas of primary concern in working at night. First, NSTPW analyzes predictions of work zone capacity and traffic flow to establish the hours of work.

The specification defines the following three levels of illumination:

[1] http://trb.org/news/blurb_detail.asp?id=1023; or contact TRB Online Bookstore, www.TRB.org/bookstore/; click on NCHRP and Reports.

[2] http://trb.org/publications/nchrp/nchrp_rpt_498.pdf; or contact TRB Online Bookstore, www.TRB.org/bookstore/; click on NCHRP and Reports.

1. Level 1, 60 lux—general site lighting for workers on foot;
2. Level 2, 110 lux—for working near certain types of equipment—for example, behind the paver, so that quality control personnel can monitor the pavement mat closely; and
3. Level 3, 220 lux—required at stations for traffic control persons (TCPs).

The contractor must assemble a trial setup of the traffic control and light systems for NSTPW review before work can begin. The specification also establishes requirements for traffic control devices that will be used at night, such as signage, flashing light units, and channelization—that is, redirecting the traffic flow with temporary markers.

The construction contractor must submit a detailed night work plan, which includes night-related traffic control plans, site safety rules, and training materials. The plan also must include detailed lighting plans designed by a professional engineer with expertise in lighting.

TCPs and other workers must receive special training in carrying out their duties at night and must wear high-visibility apparel. TCPs also must have radio communication with other TCPs and staff on the work site.

Haul trucks must have reflective signs mounted on the tailgates, directing motorists not to follow into closed traffic lanes. Trucks and heavy equipment also must add reflective material to produce an outline of the vehicle. All vehicles on the site must have rotating incandescent lights.

Application

The specification was employed during the 10-week construction period for the Highway 125 night paving project. No worker safety incidents occurred, and no complaints were received from motorists who passed through the work site.

The amount of illumination provided was adequate for a safe work environment and for high-quality work—the contractor earned a bonus for the asphalt work. Design of the lighting plan by a professional ensured that the light tower setup and the lamp-aiming geometry would minimize the glare.

Detailed observations of all aspects of the specification enabled improvements to be made for subsequent projects. The specification was used on five projects in 2003, including a full deck replacement and a structural upgrade of a major bridge. Much of the bridge rehabilitation had to be carried out at night.

Several nighttime construction projects have applied the night work specification in 2004, and others are scheduled for the 2005 construction season.

Effective lighting systems designed by professionals are key ingredients to the success of a nighttime paving project.

The specification continues to undergo updates and improvements each year.

Notable changes in the latest revision include using only drums to channelize roads with higher traffic volumes; tightening the spacing between channelization devices; setting minimum values for point illumination; and requiring an internal traffic control plan for each work zone, setting out a strategy for the safe operation of construction vehicles on the site.

Benefits

By implementing the NCHRP research findings and by learning from the experiences of other DOTs, Nova Scotia now has a state-of-the-art specification for night work. The specification has proved effective and practical, and improvements continue in response to on-site observations and further study.

Contractors have found the nighttime work productive—haul vehicles do not have to wait in the long queues that develop during daytime traffic. The motorist delays that were common during daytime construction and maintenance operations were minimized on project sites.

In addition, several jurisdictions in North America have used the NSTPW specification as a model for the development or improvement of their own night work specifications.

For more information contact Gerard E. Kennedy, Project Engineer, Nova Scotia Department of Transportation and Public Works, P.O. Box 1180, Sydney, Nova Scotia B1P 6J9, Canada (telephone 902-563-2518, fax 902-563-2517, e-mail kennedge@gov.ns.ca).

EDITOR'S NOTE: Appreciation is expressed to Amir Hanna, Transportation Research Board, for his efforts in developing this article.

Suggestions for "Research Pays Off" topics are welcome. Contact G. P. Jayaprakash, Transportation Research Board, 500 Fifth Street, NW, Washington, DC 20001 (telephone 202-334-2952, e-mail gjayaprakash@nas.edu).

Richard M. Weed

Consultant

Anyone following the progress of highway quality assurance methods over the past 30 years has undoubtedly encountered the work of Richard M. Weed. Recently retired from the New Jersey Department of Transportation (DOT) and now working as a full-time consultant, Weed has had a longstanding career interest in quality assurance, has been instrumental in pioneering many new and innovative procedures, and has published widely on the topic.

In addition to his many TRB papers, he has authored or coauthored several manuals on the development of statistical construction specifications and their analysis by computer simulation. He is a two-time winner of TRB's K. B. Woods award for outstanding papers in design and construction of transportation facilities and also received the Public Partnership Award for Science and Ethics in Transportation Research, presented by the Alliance for Transportation Research in 1995.

"When you're a novice, listen to the experts—but don't ever stop doubting and asking questions."

A graduate of Princeton University's Civil Engineering program, Weed developed a passion for engineering applications of statistical analysis and computer science when he joined New Jersey DOT.

"In the 1970s, we were developing specially tailored computer programs to perform a variety of engineering functions," Weed recalls. "An engineer would describe to someone in data processing what the program was intended to do, and weeks or months later would receive a program that invariably did something different. The problems would eventually be ironed out, but it was becoming obvious that this process would be more efficient if the engineer and the programmer were the same person."

This led Weed to embark on a master's degree program in applied statistics under a National Highway Institute (NHI) fellowship grant, with New Jersey DOT providing both financial aid and a partial leave of absence. When Weed completed his formal statistical training, New Jersey was among a handful of states that had begun to implement construction specifications based on statistical concepts.

Typically, these specifications included adjusted pay schedules that had the potential to withhold substantial sums of money from contractors who failed to deliver the specified level of quality. At the time, workable specifications were obtained only through repeated trial-and-error field tests, and these often provoked hostility from the construction industry because inordinately large pay reductions frequently were assessed.

Weed discovered that one of the immediate benefits of his statistical training was the ability to use computer simulation to analyze acceptance procedures. This made it possible to generate answers in a matter of hours that previously required months or years in the field. More importantly, it enabled corrections to be made before the procedures reached the field.

"The immediate effect of this new evaluation tool was that New Jersey's specifications began to work correctly the first time out," he notes. "The long-term effect was that the relationship between the agency and the construction industry gradually changed from being extremely adversarial to one of mutual professional respect and cooperation."

Weed notes that New Jersey DOT has continued to pioneer highway quality assurance procedures. It was among the first states to advocate the use of bonus provisions in highway construction contracts and later was recognized in the National Highway Cooperative Research Program Synthesis 212 as the first state to implement a performance-related specification incorporating the development of mathematical models relating quality characteristics to performance.

"Mathematical modeling is one of my primary interests," says Weed. "I approach it with a variant of the KISS rule—Keep It Simple but Scientific. The idea is to start with the simplest approach that makes scientific sense and switch to something more complex only if evidence or data show that the simple method is not working."

Looking back on his career, Weed says his major goals have been to put highway quality assurance on a firm mathematical and scientific footing and make it more comprehensible to its many users.

"When I first became involved in this work, there was a huge gap between the state of the art and the state of practice. Most of the statistical tools were readily available, but there was a reluctance to recognize them and use them," he notes. "Today we are light years ahead of where we were 20 years ago, because of the efforts of the many of us who believe that quality assurance specifications must be held to the same high standards as the work they govern."

"It has been a privilege and pleasure to have been part of this process," concludes Weed, adding this piece of advice to young engineers: "When you're a novice, listen to the experts—but don't ever stop doubting and asking questions."

Geoffrey D. Gosling

Aviation System Consulting, LLC

In his career as a university teacher, researcher, and independent consultant, British-born engineer Geoffrey D. Gosling has participated in a broad range of air transportation issues, including land use planning around airports, air traveler behavior in multi-airport regions, air traffic control, airport ground transportation, aviation safety and security, and aviation system performance measures.

"My goal is to better understand the many different aspects that must be integrated into the aviation system planning process," he states. "There is tremendous potential for expanded research efforts to save money on airport development projects and improve the efficiency of ongoing operations."

Gosling received a bachelor's degree in civil engineering from the University of Birmingham in England in 1968. After working for a London civil engineering firm, Gosling moved to the United States in 1974 to earn master's and doctoral degrees in transportation engineering at the University of California (UC), Berkeley.

"There is tremendous potential for expanded research efforts to save money on airport development projects and improve the efficiency of ongoing operations."

Gosling stayed on at UC-Berkeley as an assistant professor and taught courses on transportation planning, air transportation, and airport planning. Since 1987 he has organized and taught UC extension courses on airport planning and other topics to mid-career engineers.

Between 1987 and 2002, he conducted research on such issues as air traffic control, airport planning, and airport operations at UC-Berkeley's Institute of Transportation Studies. In 1996 he helped establish the National Center of Excellence for Aviation Operations Research (NEXTOR) and served as the initial program manager. Over the next 6 years, he supervised or participated in NEXTOR research projects addressing aviation safety and security, aviation system performance, and forecasting requirements for system planning.

An independent consultant since 2002, Gosling has continued to work with NEXTOR on the Global Aviation Information Network (GAIN), a government and industry partnership to improve aviation safety through the collection and sharing of safety information. He currently serves as a cochair of the GAIN working group on analytical methods and tools. Recently he helped initiate a new NEXTOR research project for the Federal Aviation Administration to explore the feasibility of developing a national database of air passenger survey information.

In the past year, Gosling has worked with the Mineta Transportation Institute at San José State University on a study for the California Department of Transportation that explores the application of smart growth principles and strategies to resolve land use conflicts around airports.

In addition to his research and consulting activities, Gosling has served as an expert witness on airport planning issues and has performed technical assistance missions for the International Civil Aviation Organization. He recently served on an independent panel that reviewed how air traffic management technology could contribute to the capacity of the San Francisco International Airport.

"There are large opportunities to use technology to enhance airport capacity, but research is needed for this to happen," Gosling notes.

He currently is working on a project for the Southern California Association of Governments to develop a regional airport demand model that can be used to predict how air passenger travel can be distributed among Southern California airports. The model will analyze the interaction between air traveler choice and airline service decisions in a way that can be integrated into the regional surface transportation modeling system.

"Developing sufficient airport capacity in major metropolitan areas to meet future demand for air transportation is one of the most difficult challenges facing the aviation system in the United States," Gosling notes. "Our ability to predict how air service will evolve in multi-airport systems and define policies that can shape that process is still at a very elementary level."

Gosling is encouraged by TRB's efforts to develop an Airport Cooperative Research Program, which has been authorized by the Vision 100—Century of Aviation Reauthorization Act. He believes the program will provide an avenue for those involved in airport planning and operations to identify problems and for researchers to gain support for new approaches.

"It continually surprises me how little we know about many critical issues in aviation planning," he remarks. "There is tremendous potential for expanded research efforts to save money on airport development projects and improve the efficiency of ongoing operations."

Active in TRB since 1978, Gosling led the effort to establish the TRB Aviation System Planning Committee and served as the first chair from 1998 to 2004. He has helped organize several National Aviation System Planning Symposia and a Conference on Airports in the 21st Century.

NEWS BRIEFS

Ohio DOT saved $2,700 in materials with the MP-1.

Multipurpose Snow Plow Reduces Costs in Ohio

The Ohio Department of Transportation (DOT) has designed and tested a multipurpose truck that improves the efficiency of plowing snow and applying salt and brine to road surfaces during wintry conditions, requiring fewer materials and reducing costs. The only one of its kind, the MP-1 can plow snow, pretreat road surfaces with brine, apply salt to snow accumulations, spray salt mixed with brine or calcium at the spinner, and flood a roadway with either brine or calcium at a rate of 100 gallons per lane-mile. With a capacity of 2,850 gallons of brine, 400 gallons of calcium, and 8 tons of salt, the MP-1 can carry sufficient material to treat the 50 to 60 lane-miles of a typical driver's route.

MP-1 allows operators to choose the application best suited to the roadway conditions and to adapt quickly to changes. Data compiled from five storms on a 31-lane-mile truck route demonstrated that Ohio DOT saved on costs with the MP-1 truck compared with the costs for a traditional snow plow. Most of the $2,700 in savings was due to the smaller amount of materials used by MP-1. Virginia is building a prototype of the truck, and Indiana has shown interest in the truck's capabilities.

Car Safety Features Save Lives

Seat belts and other government-mandated safety features have saved nearly 330,000 lives since 1960, according to a recent study by the National Highway Traffic Safety Administration (NHTSA). The study indicated that the number of lives saved annually has increased steadily from 115 in 1960 to nearly 25,000 in 2002.

NHTSA used a statistical model to estimate how many people would have died if the vehicles had not been equipped with any safety technologies, such as seat belts, braking improvements, air bags, energy-absorbing steering columns, child safety seats, improved roof strength and side impact protection, shatter-resistant windshields, and instrument panel upgrades. The study did not evaluate relatively new technologies such as side air bags and electronic stability control systems.

According to the model, seat belt use accounted for more than half of all lives saved. The report noted that passenger cars are 125 pounds heavier and cost $839 more than pre-1968 vehicles because of these safety mandates.

For more information, view the complete reports at www.nhtsa.gov/cars/rules/regrev/evaluate.

Rural Road Safety: Causes and Challenges

The U.S. Government Accountability Office (GAO) has released a report that examines the causes of rural road fatalities and the challenges to improve rural road safety. GAO undertook the study to explain why crashes on rural roads account for more than 60 percent of traffic-related deaths nationwide and why fatality rates per vehicle-mile-traveled are twice as high in rural areas as in urban areas.

The study, *Highway Safety: Federal and State Efforts to Address Rural Road Safety Challenges*, defined four primary factors contributing to rural road fatalities—human behavior, roadway environment, vehicles, and the care victims receive after a crash. Human behavior was deemed important because 70 percent of fatalities in which a seat belt was not used and the majority of alcohol- and speeding-related fatalities occurred on rural roads.

Roadway characteristics that increase the likelihood of rural crashes include narrow lanes, sharp curves, trees, and animals, while problems with vehicle design equally affect urban and rural driving. Finally, delayed medical attention at crash sites and trauma care quality in rural areas affect the care that crash victims receive, contributing to higher fatality rates.

The GAO reports that many challenges hinder efforts to improve rural road safety—for example, not all states have adopted safety belt and drunk driving laws that might curb behavior contributing to rural road fatalities. In addition, the study notes that states are limited in using federal-aid highway funds for certain rural roads, and most rural roads are the responsibility of local governments that may lack the resources to undertake projects to improve road safety. Furthermore, some states lack adequate crash data to support planning and evaluation of safety projects.

For more information, read report at www.gao.gov/new.items/d04663.pdf.

TRB HIGHLIGHTS

Technical Activities Updates

Following are highlights of the activities of one of the 11 Groups in TRB's Technical Activities Division and a summary of one recent conference.

Marine Group: Securing the Marine Transportation System

TRB hosted the Marine Transportation System (MTS) Research and Technology (R&T) Coordination Conference at the National Academy of Sciences Building in Washington, D.C., on November 16–17, 2004. The theme for the conference was "Securing the Future Vitality of the MTS Through Cooperative Research."

The program was developed in conjunction with the R&T Subcommittee of the Interagency Committee for the MTS, and financial support was provided by the U.S. Coast Guard and the Bureau of Customs and Border Protection of the Department of Homeland Security (DHS). The conference was held in conjunction with the fall meeting of TRB's Marine Board.

The conference opened with a keynote address on the federal role in MTS, presented by PB Consult Chairman Mortimer Downey, who chaired the TRB committee that studied the topic. His presentation was followed by a federal agency panel that included representatives of the U.S. Coast Guard, the U.S. Army Corps of Engineers, the National Ocean Service (NOS), the Maritime Administration, and the U.S. Department of Transportation Office of the Secretary. This opening plenary session provided an opportunity for a host of MTS stakeholders to discuss the TRB committee report.

The first day of the program ended with the plenary session, "Coordination: Key to the Future of the MTS," with presentations on maritime domain awareness (MDA) from the U.S. Coast Guard; recommendations of the U.S. Commission on Ocean Policy from NOS; and a status report on SEA-21 and MTS from the chair of the MTS National Advisory Council.

The second day of the conference opened with a keynote address by Charles McQueary, Under Secretary for Science and Technology at DHS, followed by an MTS industry stakeholder panel. The panel included representatives of ports, container shipping, inland waterways, terminals, salvage, cruise and passenger vessels, and state DOT sectors. The closing plenary session focused on next steps toward a cooperative maritime research program, with presentations by Robert Reilly of TRB's Cooperative Research Programs division and William Fornes, Program Coordinator for the National Oceanographic Partnership Program.

The conference program featured three concurrent tracks of technical sessions that included papers and invited presentations on research related to security, MTS economics, safe and efficient navigation, port operations and intermodalism, maritime domain awareness, ballast water and other environmental topics, advanced technologies and human factors, and MTS capacity. To complement the technical program, several agencies had exhibits and demonstrations highlighting their research programs available throughout the conference. Total attendance was approximately 175, representing a broad cross-section of individuals from federal and state agencies, industry, academia, and the larger research community.

Douglass Brown, Rapiscan–Ancore Corporation, gives a presentation on advanced technology for marine cargo security during a technical session at the MTS R&T Coordination Conference.

Participants at the 2004 Conference for Research on Women's Transportation Issues

Conference Focuses on Women's Travel

New research on many aspects of women's travel was presented to an international audience of researchers and policy analysts during a major international conference on women's travel issues in Chicago in November 2004. TRB sponsored the conference, which was funded by the U.K. Department for Transport, General Motors, and most of the modal administrations in the U.S. DOT, as well as four state DOTs. Participants came from Denmark, Norway, Sweden, Finland, Germany, the Netherlands, Bangladesh, Cambodia, Cameroon, Australia, and Canada. Forty research papers and eight posters were presented.

The conference opened with an overview of women's travel issues by Sandra Rosenbloom of the University of Arizona. Four breakout sessions offered more details on the specific travel issues confronted by women: disadvantaged and elderly women; women's complicated activity patterns; time, travel, and activity in women's lives; and the demands of home and job.

Susan Handy, of the University of California–Davis, spoke on the implications of transportation, access, and community design for women. The topic was explored in more detail in three breakout sessions on

- Community design and mode choice,
- Community design and walking, and
- Personal security.

(continued on next page)

Technical Activities Updates *(continued)*

Anne McCart of the Insurance Institute for Highway Safety addressed the topic of injury prevention and ergonomics. Her overview was followed by sessions focused on

- Pregnant women's travel patterns and safety,
- Injury and fatality among women of different ages, and
- Perception, protection, and crash survivability.

In the final plenary session, Michael Meyer of the Georgia Institute of Technology identified the policy and planning implications of the research presented at the conference. Breakout sessions then discussed the implications of trip behavior on planning, the implications for transportation policy, and the international experience. Gloria Jeff, Michigan DOT Director, closed the sessions with a summary of the conference and a look at future research needs.

For more information, view and listen to selected presentations from the conference at www.TRB.org/conferences/women/2004 women.htm

SAFETY IDEAS—Among the participants at the Safety Innovations Deserving Exploratory Analysis (IDEA) Committee meeting on January 6 in Washington, D.C. (*left to right*), Neil Hawks, TRB Special Programs Division Director; Claire Orth, Federal Railroad Administration; and committee member Margaret Sullivan, Paccar Technical Center, discuss the evaluation and selection of proposals. Committee members also commented on presentations describing two current Safety IDEA projects designed to improve railroad safety.

IN REVIEW—Members of the Committee for Review of the Oregon Department of Transportation (DOT) Study on Bridge Shear traveled to Oregon in December 2004 to inspect bridges that are experiencing cracked girders. The committee is conducting a peer review of an Oregon State University study, commissioned by Oregon DOT, that develops a method for determining the carrying capacity of concrete bridge girders with shear cracking and predicts the remaining useful life.

PROJECT IN MOTION—The Committee for Determination of the State of the Practice for Metropolitan Area Travel Forecasting held its first meeting January 6–7, at the Keck Center in Washington, D.C. The committee invited a panel of stakeholders to provide perspectives on what could be accomplished by the project. Committee Chair Martin Wachs (*second from left*), University of California–Berkeley, and committee member Thomas Deen (*far right*), former TRB Executive Director, listen to remarks by (*from left)* Michelle Pourciau, D.C. Department of Transportation; Michael Replogle, Environmental Defense; and Jerry Faris, Chair of TRB's Committee on Transportation Planning Applications.

MODEL FACILITY— During a September 2004 meeting in Montreal, members of the Committee on the St. Lawrence Seaway visited the Port of Montreal, where they examined a scale model of the port facilities. The committee was asked to explore innovative concepts that would eliminate further introductions of nonnative aquatic species into the Great Lakes by oceangoing vessels transiting the St. Lawrence Seaway, while continuing to expand global commerce of the Great Lakes region. The centerpiece of this project will be a design-style competition that will be launched later this year to identify promising concepts worthy of further investigation.

CALENDAR

TRB Meetings 2005

March

23–24 Future Truck and Bus Safety Research Opportunities Conference (*by invitation*)
Washington, D.C.
Richard Pain

April

4–6 17th Biennial Symposium on Visibility and Traffic Control Devices
Washington, D.C.
Richard Cunard

13–15 International Conference on Best Practices for Ultra-Thin and Thin Whitetoppings*
Denver, Colorado

18-20 12th International HOV Systems Conference: Improving Mobility and Accessibility with Managed Lanes, Pricing, and BRT
Houston, Texas

24–28 2005 Transportation Planning Applications Conference
Portland, Oregon
Kimberly Fisher

May

1–4 10th International American Society of Civil Engineers Conference on Automated People Movers: Moving to Mainstream*
Orlando, Florida

3 Aggregates for Highway Construction: Characterization and Performance
Wilmington, North Carolina
G. P. Jayaprakash

8–11 International Workshop on Life-Cycle Cost Analysis and Design of Civil Infrastructure Systems*
Cocoa Beach, Florida
Stephen Maher

11–13 Census Data for Transportation Planning: Preparing for the Future
Irvine, California
Thomas Palmerlee

22–25 National Roundabout Conference
Vail, Colorado
Richard Pain

June

5–9 Southeast Community Impact Assessment Workshop*
Scottsdale, Arizona

20–24 7th International Symposium on Utilization of High Strength–High Performance Concrete*
Washington, D.C.
Frederick Hejl

27–30 3rd International Driving Symposium on Human Factors in Driver Assessment, Training, and Vehicle Design*
Rockport, Maine
Richard Pain

27–July 2 3rd International Symposium on Highway Geometric Design
Chicago, Illinois
Richard Cunard

July

7-9 Rail Caucus
Boston, Massachusetts
Peter Shaw

8–9 Commodity Flow Survey Conference
Boston, Massachusetts
Thomas Palmerlee

10-12 TRB Joint Summer Meeting
Boston, Massachusetts
Mark Norman

10-12 30th Annual Summer Ports, Waterways, Freight, and International Trade Conference
Boston, Massachusetts
Joedy Cambridge

11–13 Symposium on Stormwater Management for Highways
Sanibel Island, Florida
Stephen Maher

17–19 Environmental Stewardship in Transportation Through Waste Management, Materials Reuse, and EMS
Charlotte, North Carolina
Kimberly Fisher

17–20 6th International Bridge Engineering Conference
Boston, Massachusetts

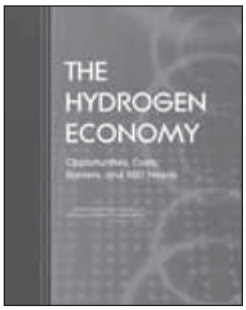
17–20 44th Annual Workshop on Transportation Law
Portland, Oregon
James McDaniel

Additional information on TRB conferences and workshops, including calls for abstracts, registration and hotel information, lists of cosponsors, and links to conference websites, is available online (www.TRB.org/trb/calendar). Registration and hotel information usually is available 2 to 3 months in advance. For information, contact the individual listed at 202-334-2934, fax 202-334-2003, or e-mail lkarson@nas.edu/. Meeting listings without TRB staff contacts have direct links from the TRB calendar web page to additional information.

*TRB is cosponsor of the meeting.

BOOK SHELF

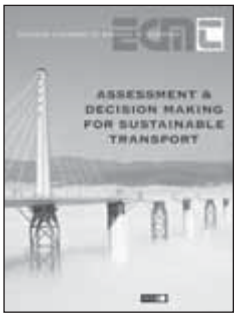
The Hydrogen Economy: Opportunities, Costs, Barriers, and R&D Needs.



National Research Council. Washington, D.C.: 2004; 256 pp.; $32; 03-090-9163-2.

The National Research Council (NRC) assesses the challenges that must be overcome if hydrogen is to make a significant contribution to the long-term energy economy of the United States. Produced at the request of the U.S. Department of Energy, the report examines hydrogen end-use technologies, transportation, hydrogen production technologies, and transition issues for hydrogen in vehicles. Key technical issues for a hydrogen economy are discussed, including the current state of technology; future cost estimates; CO^2 emissions; distribution, storage, and end-use considerations; and the role of the DOE Research, Development, and Demonstration program.

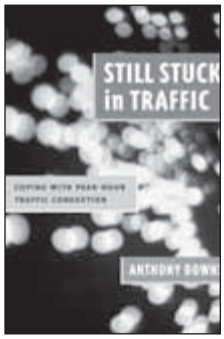
Assessment and Decision Making for Sustainable Transport



Organisation for Economic Co-operation and Development. Bedfordshire, United Kingdom: 2004; 234 pp.; $69; 92-821-1311-6.

According to this report, more sustainable development in the transportation sector hinges on delivering results of economic appraisals and environmental assessments to technical and political decision makers in ways that are clear, concise, and transparent. After reviewing recent experience in infrastructure planning and policy development in seven countries, the report presents recommendations for good practice in the transportation sector.

Still Stuck in Traffic: Coping with Peak-Hour Traffic Congestion

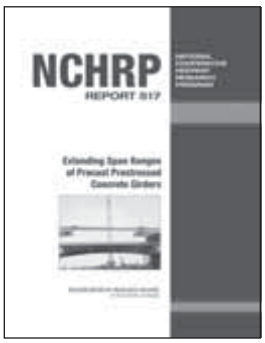


Anthony Downs. Brookings Institution Press. Washington, D.C.: 2004; 455 pp.; $26.95; 0-8157-1929-9.

In this revised and expanded edition of *Stuck in Traffic*, Anthony Downs examines the benefits and costs of various anticongestion strategies. He explains why expanding public transit and adding to roads have unintended consequences that negate the apparent advantages. He argues that most land use strategies have little effect and that the most powerful solutions, including higher gasoline taxes, increased public funding for transit, and highway tolls, are also the least palatable politically. *Still Stuck in Traffic* contains new material on the causes of congestion, its dynamics, and its relative incidence in various parts of the country. Downs explores why traffic congestion has become part of modern American life and how the congestion can be controlled.

The books in this section are not TRB publications. To order, contact the publisher listed.

TRB PUBLICATIONS



Extending Span Ranges of Precast Prestressed Concrete Girders

NCHRP Report 517

This report presents the findings of research to develop recommended load and resistance factor design procedures for achieving longer spans using precast prestressed concrete bridge girders.

2004; 555 pp.; TRB affiliates, $26.25; nonaffiliates, $35. Subscriber category: bridges, other structures, and hydraulics and hydrology (IIC).

Safety Evaluation of Permanent Raised Pavement Markers

NCHRP Report 518

The safety performance of snowplowable, permanent raised pavement markers (PRPMs) on two-lane roadways and four-lane freeways is evaluated. Researchers also developed an analytical engineering procedure to determine the potential cost-effectiveness of implementing PRPMs at a location. This procedure relies on safety performance functions or crash prediction models for roadways with and without PRPMs.

2004; 60 pp.; TRB affiliates, $15; nonaffiliates, $20. Subscriber categories: highway operations, capacity, and traffic control (IVA); safety and human performance (IVB).

Connection of Simple-Span Precast Concrete Girders for Continuity

NCHRP Report 519

This report presents research on details and specifi-

TRB PUBLICATIONS *(continued)*

cations for the design of continuity connections for precast concrete girders. Examples illustrate the design of four precast girder types made continuous for live loads.

2004; 190 pp.; TRB affiliates, $20.25; nonaffiliates, $27. Subscriber category: bridges, other structures, and hydraulics and hydrology (IIC).

Integrating Tourism and Recreation Travel with Transportation Planning and Project Delivery
NCHRP Synthesis 329
The TRB Task Force on Transportation Needs for National Parks and Public Lands originally conceived this synthesis study, recognizing the need to determine how well and how often tourism and recreational travel are included in transportation planning and decision making. The report describes current practice and presents selected case studies and survey information pertaining to the types of agencies involved in tourism, recreation, and transportation planning. The report also presents agency priorities and concerns, forms of multi-agency coordination, funding and implementation policies, data analysis and evaluation, and identification of successful planning or project delivery activities.

2004; 53 pp.; TRB affiliates, $11.25; nonaffiliates, $15. Subscriber category: planning and administration (IA).

Public Benefits of Highway System Preservation and Maintenance
NCHRP Synthesis 330
Maintenance of highways and bridges can entail repairing damage from vehicle crashes, catastrophic natural events, or various activities to forestall the wear and tear of normal aging and use. This report reviews practices for measuring and articulating the benefits of highway system preservation and maintenance (including the usually adverse effects of deferring maintenance) and communicating those benefits to stakeholders—road users, elected officials, and others interested in the system's performance.

2004; 45 pp.; TRB affiliates, $11.25; nonaffiliates, $15. Subscriber categories: planning and administration (IA); maintenance (IIIC); highway operations, capacity, and traffic control (IVA).

State Highway Letting Program Management
NCHRP Synthesis 331
This synthesis summarizes information on statewide letting programs. It documents how state highway agencies manage letting programs from planning and programming through the awarding of contracts for construction projects. The study identifies elements, approaches, tools, and techniques to develop and manage letting programs; evaluates how change has influenced letting schedules; identifies contract awards issues that may influence the outcomes of specific lettings; and assesses states' interest in data sharing for letting program management.

2004; 47 pp.; TRB affiliates, $11.25; nonaffiliates, $15. Subscriber categories: planning and administration (IA); materials and construction (IIIB).

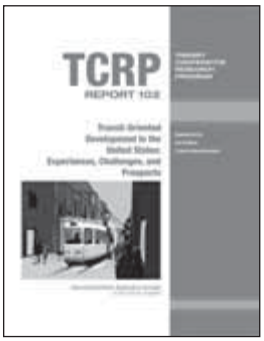
Traveler Response to Transportation System Changes; Chapter 12: Transit Pricing and Fares
TCRP Report 95, Chapter 12
The *TCRP Report 95* series comprehensively documents various transportation system changes, policy actions, and alternative land use and site development design approaches. This third edition of *Traveler Response to Transportation System Changes* covers 18 topic areas—including 9 new areas—each to be published as a stand-alone chapter. Chapter 12 focuses on rider response to fare changes for conventional urban-area bus and rail transit services. Topics cover free transit and changes in fare level and fare structure, including relationships among fare categories.

2004; 59 pp.; TRB affiliates, $15; nonaffiliates, $20. Subscriber categories: planning and administration (IA); highway operations, capacity, and traffic control (IVA); public transit (VIA).

Toolkit for Rural Community Coordinated Transportation Services
TCRP Report 101
This report examines strategies and practices to coordinate rural transportation services and identifies model processes for local coordination efforts in rural communities. A stand-alone executive summary provides information, instructions, and lessons learned from rural communities that have implemented coordinated transportation services.

2004; 428 pp. and a stand-alone executive summary; TRB affiliates, $27; nonaffiliates, $36. Subscriber categories: planning and administration (IA); public transit (VIA).

Transit-Oriented Development in the United States: Experiences, Challenges, and Prospects
TCRP Report 102
A comprehensive assessment of the state of the practice and the benefits of transit-oriented development (TOD) and joint development throughout the



BOOK SHELF

TRB PUBLICATIONS *(continued)*

United States, this report offers insight into the various aspects of implementing TOD, including political and institutional factors; planning and land use strategies, benefits, and impacts; fiscal considerations and partnerships; and design challenges and considerations.

2004; 524 pp.; TRB affiliates, $33.75; nonaffiliates, $45. Subscriber categories: planning and administration (IA); public transit (VIA).

Operational Experiences with Flexible Transit Services
TCRP Synthesis 53
In response to growth patterns, economic trends, and social changes that have not favored traditional forms of transit service, researchers and transit planners have proposed services that combine the features of conventional fixed-route service and demand-responsive service. This synthesis presents the experiences of transit operators with flexible transit services—hybrid services that are not purely demand responsive. The report examines operation, ridership markets, ridership threshold levels, costs and funding, operating procedures and technology, design factors and criteria, training, marketing, and successes and failures. Six types of services are analyzed: request stops, flexible-route segments, route deviation, point deviation, zone routes, and demand-responsive connector service.

2004; 57 pp., TRB affiliates, $12; nonaffiliates, $16. Subscriber category: public transit (VIA).

Maintenance Productivity Practices
TCRP Synthesis 54
Tight operating budgets are forcing transit agencies to revise productivity practices without compromising safety and quality. This synthesis summarizes maintenance productivity improvements applied by public transit providers of varying size, union affiliation, and operating conditions. The report describes successful programs and creative modifications to programs. Topics discussed include standard times for maintenance practices and collective bargaining agreements for setting the times, as well as quality assurance, preventive maintenance programs, productivity measurements, classification of maintenance personnel, new technology diagnostic tools, maintenance productivity techniques and practices, and the comparative advantages of doing work in-house or contracting out.

2004; 92 pp., TRB affiliates, $13.50; nonaffiliates, $18. Subscriber category: public transit (VIA).

Transportation Finance, Economics, and Economic Development 2004
Transportation Research Record 1864
Examined are a mileage-based approach for charging vehicles that travel on public roadways, the value pricing toll program at the Port Authority of New York and New Jersey, the per mile costs of operating automobiles and trucks, the long-run changes in driver behavior due to variable tolls, infrastructure development in Germany under stagnating demand conditions, and the results of the 2003 Transportation Management Association Survey.

2004; 159 pp.; TRB affiliates, $37.50; nonaffiliates, $50. Subscriber category: planning and administration (IA).

Highway Safety: Older Persons; Traffic Law Enforcement; Management and Trucking
Transportation Research Record 1865
The highway safety topics presented in this volume include the effects of a controlled auditory–verbal distraction task on older driver vehicle control; of standard enforcement on safety belt citations in Michigan; of yellow-interval timing on the frequency of red-light violations at urban intersections; and of day length on sleep habits and subjective on-duty alertness in irregular work schedules.

2004; 97 pp.; TRB affiliates, $32.25; nonaffiliates, $43. Subscriber category: safety and human performance (IVB).

Maintenance and Management of Pavement and Structures
Transportation Research Record 1866
The performance of joint sealants and the structural conditions of the pavements at the Ohio Route 50 test site after 3 years in service are reported. A comprehensive framework is presented for a bridge deck management system that aims at integrating project- and network-level decisions into a unified model to optimize costs at both levels. A performance evaluation system for the main reinforced concrete girders of bridges also is described.

2004; 91 pp.; TRB affiliates, $32.25; nonaffiliates, $43. Subscriber category: maintenance (IIIC).

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INFORMATION FOR CONTRIBUTORS TO

TR NEWS

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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, typewritten pages), summarized briefly but thoroughly by an abstract of approximately 60 words. Authors should also 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 help readers better understand 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 photographic 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 is used. 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. Because of the lead time required for publication and the 2-month interval between issues, notices of meetings should be submitted at least 4 to 6 months before the event. Due to space limitations, these notices will only appear once.

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, and price. Publishers are invited to submit copies of new publications for announcement, and, on occasion, guest reviews or discussions will be invited.

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.

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Providing the Groundwork

Performance measures, succession planning, and transportation in national parks and public lands—these diverse topics are receiving increased attention from state departments of transportation, universities, transit and other modal agencies, and industry organizations. TRB has examined many aspects of these issues and has produced a bookshelf of information for transportation professionals, decision makers, and the general public, to assist in providing the products and services that ensure a safe, reliable, and secure transportation system. Here are some of the recent titles TRB has published on these key topics:

Performance-Based Measures in Transit Fund Allocation
TCRP Synthesis 56, ISBN 0-309-07018-X, 74 pages, 8.5 x 11, paperback, $16 (2004)

Strategic Planning and Decision Making in State Departments of Transportation
NCHRP Synthesis 326, ISBN 0-309-07001-5, 62 pages, 8.5 x 11, paperback, $16 (2004)

Guide for Customer-Driven Benchmarking of Maintenance Activities
NCHRP Report 511, ISBN 0-309-08786-4, 271 pages, 8.5 x 11, paperback, $30 (2004)

Transportation Management and Public Policy 2004
Journal of the Transportation Research Board, No. 1885, ISBN 0-309-09480-1, 130 pages, 8.5 x 11, paperback, $48 (2004)

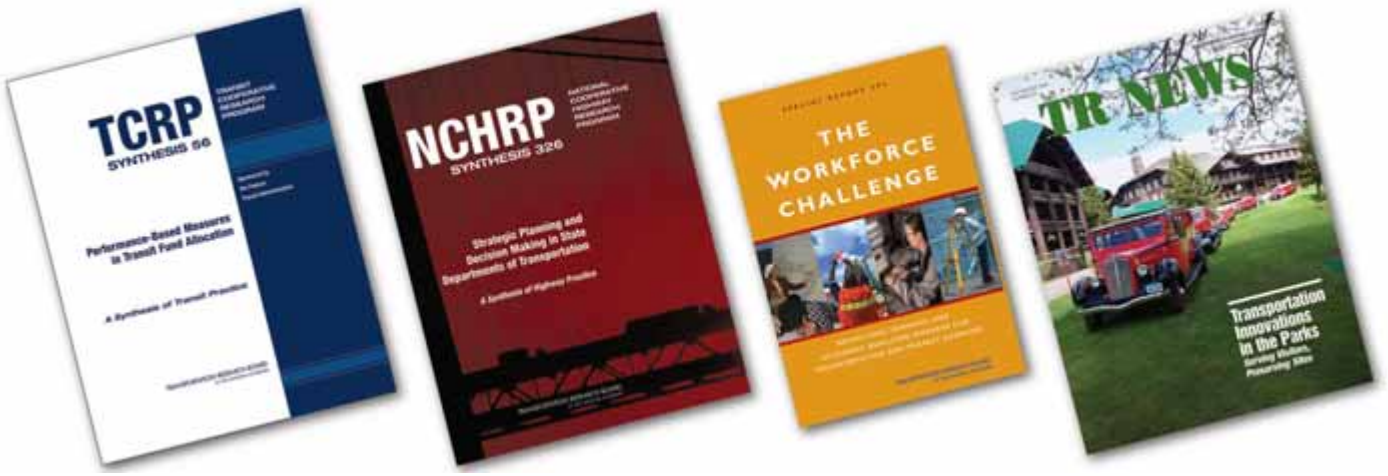
Strategies to Increase Coordination of Transportation Services for the Transportation Disadvantaged
TCRP Report 105, ISBN 0-309-08813-5, 77 pages, 8.5 x 11, paperback with appendix material on CD-ROM, $31 (2004)

Statewide Highway Letting Program Management
NCHRP Synthesis 331, ISBN 0-309-07008-2, 47 pages, 8.5 x 11, paperback, $15 (2004)

Transportation Innovations in the Parks: Serving Visitors, Preserving Sites
TR News, No. 233, 48 pages, 8.5 x 11, paperback, $9.50 (July–August 2004)

Integrating Tourism and Recreation Travel with Transportation Planning and Project Delivery
NCHRP Synthesis 329, ISBN 0-309-07006-6, 53 pages, 8.5 x 11, paperback, $15 (2004)

The Workforce Challenge: Recruiting, Training, and Retaining Qualified Workers for Transportation and Transit Agencies
Special Report 275, ISBN 0-309-08563-2, 186 pages, 6 x 9, paperback, $23 (2003)



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