



THE STATE OF TRANSPORTATION

Specialists 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.

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

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 transporta-

tion 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.

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.



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



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: ROFEE 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

- ◆ Louisiana 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



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

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.

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 opti-

³ www.fhwa.dot.gov/environment/wildlife/protection.

mize 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.

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 CARENTER, 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



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

PHOTO: ATLANTIC SOUTHEAST AIRLINES, INC.

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.

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



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

materials, technologies, and procedures.

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;



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.

⁶ <http://mobility.tamu.edu/ums/report/>.



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 coor-

dinating 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 NEWMAN, 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 non-indigenous 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: DETROIT-WINDSOR TRUCK FERRY

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



PHOTO: BRIAN LOWBARD, NEW HAMPSHIRE DOT

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

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 multi-state 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”



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.

population group ages, transit ridership special needs are on the rise, particularly in rural areas.

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.