The Changing Transportation Scene

TRB's 1999 Field Visit Program

Specialists in the Transportation Research Board Technical Activities Division are in a unique position to identify the current concerns and learn about the activities of the transportation community. The TRB Annual Meeting, Board-sponsored conferences and workshops, standing committees, publications, and contact with thousands of organizations and individuals provide TRB staff with information on all modes of transportation from both the public and private sectors.

A major source of such information is the annual field visit program, through which TRB staff meet on site with each state transportation department, many universities, transit and other modal agencies, and industry representatives. The objectives of the program are to (a) learn of problems facing these organizations and transmit information from states, industry, or educational institutions that can help solve those problems; (b) learn of research activities that are in progress or contemplated and exchange information on similar research being carried out elsewhere, thus preventing duplication of efforts; (c) identify new methods and procedures that might be applicable elsewhere; (d) identify innovative or experimental work that may not be widely published, but is worthy of broader attention; (e) describe the Board's range of services to new staff at transportation agencies that support TRB; and (f) identify potential candidates for TRB committees.

Presented here are the issues, concerns, and recent program changes in transportation identified by the TRB Technical Activities Division staff through this year's field visits, supplemented with related information from other sources. The time period covered is calendar year 1999 unless otherwise noted.

Overview

During the past year, the transition from the Intermodal Surface Transportation Efficiency Act of 1991 to the Transportation Equity Act for the 21st Century presented the states and federal agencies with many new challenges. Among the most welcome of these challenges was the need to ramp up construction and other programs in light of the increased funding provided by TEA-21. The impacts of these new funding levels were a dominant theme of this year's field visit program, as were innovative financing mechanisms, not only for highways and transit, but for the other modes as well. Important themes also included delays and uncertainty in aviation funding, rail mergers and acquisitions, and intermodal initiatives.

Safety concerns, while not necessarily new or unique in 1999, certainly were a leading driver of transportation programs. The U.S. Department of Transportation views transportation safety as a matter of national concern to be addressed at all levels, and the American Association of State Highway and Transportation Officials is pursuing the *AASHTO Strategic Highway Safety Plan*, published in 1998 (*1*). Long-standing safety problems, such as those associated with work zones and rail–highway grade crossings, combine with problems resulting from relatively recent transportation forms, such as high-speed rail, to present a major challenge to the profession. And there is increasing attention to the problem of road rage, along with the newly designed countermeasures being employed by the states.

Environmental issues also continue to be key drivers of transportation programs. The confrontational tone that has dominated efforts to address issues of construction versus environment appears to be diminishing. Practices such as context-sensitive design and streamlining of environmental processes, described later in this report, indicate that cooperation is replacing confrontation.

The past year has been exciting on the research front. TEA-21 provided a significant increase in highway and transit research funding. State highway research programs and the AASHTO-sponsored National Cooperative Highway Research Program saw a 50 percent increase in funding. At the same time, however, the Federal Highway Administration program was affected by earmarks that severely limited the discretionary research the agency could conduct in its traditional areas. This situation, coupled with the agency's recent reorganization, has resulted in an interesting year for FHWA.

As a result of both the change in the levels of research funds available to various agencies and a general desire to use funds most effectively, FHWA, AASHTO, and TRB initiated the National Highway Research Partnership Forum. The partnership, now in the early stages of development, will explore ways of identifying research needs and the best means of meeting those needs through outreach to the entire transportation community. Additional details are provided at the Forum's website (www4.national-academies.org/trb/homepage.nsf/web/r&t_forum).

The positive impacts of TEA-21 funding on state research programs are both welcome and long overdue. State research programs have for some time competed for funding with other highway programs (especially those focused on planning), and the overall increase in funding for all programs should help the state research units meet their needs. Some states have increased their research staff, while others are attempting to expand their programs with the same number of staff. Additional flexibility has been provided for partnering efforts, matching funds for University Transportation Center projects, and pooled-fund projects involving multiple states. In fact, there appears to be considerable interest in state-led pooled-funding initiatives.

The long-standing AASHTO/FHWA partnership also came into play this year when AASHTO's Standing Committee on Research provided NCHRP funds that allowed certain projects associated with the Strategic Highway Research Program, previously funded by FHWA, to continue. This solution, although a temporary one, demonstrates the value of and potential for coordination and cooperation among national and state research programs.

Institutional Concerns

Key institutional issues raised during the field visits relate to finance, environmental concerns, education and training, and planning.

Finance

During the 6-year ISTEA period (1991–1997), U.S. DOT explored a number of new alternatives to the traditional grant-in-aid approach to project financing. One of the most promising of these new approaches was direct federal credit assistance. The goal was to leverage federal funds by attracting substantial private and other nonfederal investments in critical improvements to the nation's surface transportation system. U.S. DOT accomplished this goal by providing three forms of credit assistance: secured (direct) loans, loan guarantees, and standby lines of credit. The assurance of federal credit backing was intended to attract investors who might otherwise have found a project too risky or potentially unremunerative.

The ISTEA pilots of federal credit assistance were very successful. The Alameda Corridor intermodal freight project and two California toll road projects used federal credit to help attract other investments and to advance these large projects much more rapidly than might otherwise have been possible. Subsequently in 1998, Congress signed into law the Transportation Infrastructure Finance and Innovation Act (TIFIA), and the TIFIA program was continued by TEA-21. Under TIFIA, U.S. DOT can provide $10.6 billion in direct federal credit assistance. The agency will publish a solicitation for applications at least once a year. From the applications received, a multiagency steering committee will select projects for TIFIA assistance. In September 1999, U.S. DOT named the first five projects to benefit from the program:

- SR 125 in San Diego, a $400 million, 9-mile segment of toll road connecting San Diego to the U.S. border, will receive a loan guarantee of $90 million and a $37 million line of credit.
- Miami Intermodal Center, adjacent to Miami International Airport, is a $1.4 billion project that includes a consolidated rental car facility, an automated people mover, strategic highway improvements, and links to transit. The project will receive loans totaling $436 million.
- Tren Urbano, a $1.7 billion transit system under construction in San Juan, Puerto Rico, will receive a $300 million loan.
- Farley-Pennsylvania Station Redevelopment Project in New York City is a $750 million effort to convert the Farley post office building into an intermodal facility and commercial center serving rail passengers. The project will receive a loan of $140 million and a $20 million line of credit.

The Metro Capital Program, a $2.3 billion capital improvement effort for the Washington, D.C., metropolitan transit system, will be financed by the new approach of direct federal credit assistance.

♦ The Metro Capital Program is a 20-year, $2.3 billion capital improvement effort for the Washington, D.C., metropolitan transit system. The program will receive a $600 million loan guarantee.

U.S. DOT estimates that every TIFIA dollar spent on these five major projects will contribute to more than $100 in capital investment.

TRB's National Conference on Transportation Finance is planned for August 20–30, 2000. It will examine these and other new transportation finance approaches. In addition, a new project planned by NCHRP will monitor exemplary innovative finance projects and broadly disseminate information about these projects on an ongoing basis.

Environmental Concerns

A perception within many state DOT environmental offices is that environmental reviews for plans and projects take too long to complete. The reasons given for this situation vary, and include unresponsive state and federal regulatory agencies, lack of staff resources at regulatory agencies, and inability to conduct concurrent reviews to satisfy various requirements. In response to these concerns, Congress adopted Section 1309 of TEA-21, requiring that FHWA and the Federal Transit Administration implement a coordinated environmental review process to expedite federal-aid highway and transit projects. This initiative is termed "environmental streamlining."

After conducting a series of listening sessions to understand the concerns of the various stakeholder groups, U.S. DOT initiated a national Memorandum of Understanding (MOU) among implementing agencies and those responsible for environmental reviews. This MOU includes two categories of actions aimed at producing a better review process: one designed to reduce project delays, and the other to protect and enhance environmental quality. The MOU closes with these words: "We will strive to ensure that transportation projects are protective of and more compatible with the natural and human environment and we commit to continuously improve and streamline the processes used to develop these projects." In July 1999, this document was signed by representatives of the U.S. Departments of Transportation, Interior, Commerce, and Agriculture, as well as the U.S. Army Corps of Engineers, the Environmental Protection Agency, and the Advisory Council for Historic Preservation.

Additional actions being taken by U.S. DOT to implement streamlining include a tool kit that provides examples of interagency programmatic agreements, partnering initiatives, and other successful practices. This tool kit has been posted on the web (www.fhwa.dot.gov/environment/index.htm). Another important action authorized by Section 1309 is federal cost reimbursement that allows state DOTs to use federal-aid funds to reimburse resource agencies for expediting reviews.

A number of state DOTs have pointed out that streamlining would be more meaningful if it were accompanied by benchmarking, performance measures, and other tools for measuring progress. For its part, the environmental community has noted that for projects whose review takes a long time, it is important to differentiate between cases

in which the delay is caused by procedural issues and those in which the delay reflects strong opposition from a significant number of citizens.

Education and Training

As part of the field visit program, TRB staff travel to universities that have transportation research and education programs. The principal purpose of these visits is to discuss current and planned research activities, but a collateral purpose is to identify emerging issues and changing practices in the conduct of transportation education and training.

There are many pressures to reform the education of transportation professionals and technicians. These pressures include the evolving nature of the profession and the need for skills in working with new telecommunications technologies, increasing emphasis on multimodal and intermodal facilities and operations, the emergence of innovative financing and construction management practices, and an activist public that demands to be included directly in decision making. Another pressure for reform is competition for technically skilled students from educational programs in information technology. In addition, the demands on the profession are changing so quickly that continual retraining of midcareer employees is becoming a top priority.

A recent paper by Louis Pignataro, New Jersey Institute of Technology, and Lester Hoel, University of Virginia, considers some of the constraints on teaching institutions in responding to these new imperatives (*2*). University academic programs in transportation share certain common features. Traditionally, transportation has been a subspecialty of the civil engineering discipline. Most programs today are interdisciplinary and require interdepartmental coordination of courses. The disciplines and departments involved may include engineering, planning, economics, architecture, geography, operations research, business, physical sciences, and others. In most cases, the transportation program is at the graduate level. Many universities also have transportation centers, but these centers typically focus on administration of a research program, not an academic program.

While an interdisciplinary, interdepartmental approach responds to the increasing need for change and diversity in education for the transportation profession, there are some potential drawbacks as well. Departments are the basic unit of a university academic program, and are responsible for developing curriculum; teaching classes; awarding degrees; and making hiring, tenure, and promotion decisions for their faculty. Departments are likely to focus on their own core needs instead of those of another department or a cross-disciplinary program. Full credit may not be granted to faculty who participate in activities outside their home department. Inherent biases of this sort may impair a program's ability to attract faculty, students, and funding.

Bureaucracy is another issue when multiple departments are involved in a program. Pignataro and Hoel mention one case in which those responsible for an interdisciplinary university transportation program wished to change its name from "Transportation Planning" to "Transportation." Making this change involved review by each department's curriculum committee, each college's

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In the education of transportation professionals and technicians, increasing emphasis should be placed on multimodal and intermodal facilities and operations.

curriculum committee, the university's curriculum committee, the faculty senate, the graduate school, and the university council, and, finally, approval by the Board of Regents. The process took 2 years.

One way of improving the delivery of university transportation education would be to concentrate the authority for transportation education into a single entity with no other mission. At the New Jersey Institute for Technology, for example, there is an Institute for Transportation that administers the academic program and offers M.S. and Ph.D. degrees in transportation. The Institute is responsible for admitting students into the graduate program and certifying that they have met degree requirements.

Another useful model may be to create within a university a full Department for Transportation Studies, with a nucleus of full-time faculty and a core curriculum. Creation of such a department would appear warranted by the maturation and increasing uniqueness of the transportation discipline, the number of students seeking graduate degrees in transportation topics, the pressing need for continuing education of transportation professionals, and the vital importance of the transportation system to the nation's well-being. More than 50 U.S. universities currently have centers devoted to transportation research. The time may have arrived for transportation education to have a similar independent status.

Planning

In response to the requirements of ISTEA, all states have developed and are maintaining statewide transportation planning processes. The characteristics of the transportation planning process vary from state to state in accordance with a number of factors, including demographics; the size of the state; and socioeconomic, geographic, and economic conditions. Statewide transportation planning requirements were retained but revised in TEA-21. Associated regulations have not yet been issued, but are expected to provide more flexibility for individual states in the conduct of planning.

A key trend among the states is reassessment of planning and program delivery procedures to increase overall efficiency. The majority of the states are shifting from the production of a single statewide plan to the establishment of a continuing planning efforts. The process is being linked to other, related planning efforts, such as strategic planning, performance-based planning (which is receiving increased attention), environmental planning and programming, growth management, and application of management systems.

Greater attention is being given to goods movement in statewide planning processes as a result of dramatic changes affecting the freight industry.

The integration of system management and operations into the planning process is receiving increased attention in a number of states as well. Of particular interest are the impacts of intelligent transportation systems and telecommuting.

Goods movement planning is receiving greater emphasis in statewide planning processes as a result of some dramatic changes that are affecting the freight industry. These changes include globalization of the economy, free trade, demand for just-in-time delivery, larger ships, mergers of railroads, and consolidation of ports. As a result, a number of states are allocating more resources to their freight transportation planning activities.

Planning tools are changing as well. Models and applications for statewide and urban travel demand forecasting are undergoing significant changes in orientation and structure. Quick-response tools are being used to evaluate alternative strategies or address specific legislative requirements. In addition, recent advances in geographic information systems, global positioning systems, 3-D visualization, and remote sensing are offering more effective ways of analyzing and displaying the results of statewide planning efforts.

Another notable feature of statewide planning processes is the early involvement of customers in identification of issues and development of the plan itself. Methods of involving the public, as well as tools for analyzing and presenting the results of the process and proposed solutions, are receiving increased attention among the states.

Marine Transportation

During the next 20 years, waterborne commercial vessel traffic is projected to double or triple in volume, placing significant demands on the nation's maritime infrastructure and the landside connections to more than 1,900 deep-draft and 1,700 shallow-draft terminals. In September 1999, U.S. DOT, with the support and cooperation of the Marine Transportation System (MTS) National Task Force, transmitted to Congress *An Assessment of the United States Marine Transportation System (3)*. The MTS National Task Force includes representatives from federal agencies and departments and a number of private-sector organizations. TRB staff and representatives of the Board's standing committees involved in marine transportation participated in the efforts of the task force, and continue to provide support to the MTS initiative.

At the MTS R&D Coordination Conference, held in November 1999 in Washington, D.C., federal agencies and private-sector researchers reported on recent and planned maritime research and development activities, as well as the design and implementation of a national maritime cooperative research program. The level of maritime research funding has declined during the past decade. The reduced funding has been exacerbated by disagreement over how to fund much-needed improvements in port, channel, and waterway infrastructure. The maritime community comprises a diverse set of players sharing many issues and problems. A focused approach, such as would be achieved through the above cooperative research program, is needed along with the necessary financial resources required to support R&D activities.

Louisiana offers an example of how one state, recognizing the importance of the marine component of its transportation system, has provided support for needed improvements. For nearly a decade, Louisiana has had in place a Port Construction and Development Priority Program, funded through the state's Transportation Trust Fund and administered by the Department of Transportation and Development. The program enables state participation in port infrastructure projects through a secure, constitutionally protected funding source. To date, the state has invested more than $160 million in the program. It is estimated that this investment will result in more than $1 billion in economic benefits, including the retention or creation of 4,000-plus jobs. By helping provide improved access to and connectivity between highway, rail, air, and waterway facilities, the program is consistent with the national emphasis on intermodalism.

After a 1-year delay, the Water Resources Development Act (WRDA) was passed in August

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1999. In addition to projects already approved in New York, the act authorized work to begin on a number of major channel improvement projects, including those in Maryland, Georgia, South Carolina, Florida, and California and on the Columbia River. Effort is already under way on WRDA 2000, which is likely to focus more attention on inland waterway projects.

Debate continues on finding an alternative funding mechanism to replace the Harbor Maintenance Tax and the Harbor Maintenance Trust Fund for maintaining federal channel and harbor projects. Maritime interests closely reviewed findings contained in a General Accounting Office report transmitted to Congress in September 1999 (*4*). The report states that there are currently 124 assessments imposed on the commercial maritime industry by 11 different federal agencies. Together, these agencies collected almost $22 billion in fiscal year 1998 from fees such as customs duties, ship registry fees, commercial fishing fees, and inspection charges. The vast majority of the total revenues ($20 billion) was not earmarked for special purposes and was deposited in the General Fund of the U.S. Treasury.

The marine transportation system is also an important element in the movement of people. There are ferry systems in 35 states on more than 260 ferry routes, more than 100 of which are lifeline routes linking island communities to the mainland. Ferries carry an estimated 134 million Americans and tens of millions of vehicles (cars, trucks, bicycles, railcars), helping relieve congestion on other surface transportation modes. At the national level, TEA-21 recognized the current and future importance of ferry operations and authorized a National Ferry Study. That study is now under way, and will produce a compilation of information on existing ferry services, as well as forecasts of new routes and technologies for ferry vessels. Individual states are also focusing renewed attention on the importance and potential of ferry transportation. For example, the Rhode Island Department of Transportation and the State Planning Council prepared the Rhode Island Waterborne Passenger Transportation Plan to examine the potential for use of the state's bays, harbors, and rivers for the movement of passengers.

Other users of the marine transportation system include recreational boaters, fishing vessels, cruise lines, and gaming vessels, as well as those who build and repair ships. The safety and environmental pressures associated with the growing volume and diversity of water traffic were the focus of a March 1999 TRB/Marine Board symposium held in Irvine, California. These critical issues are also summarized in a recent article in *TR News (5)*.

TRB's Summer Conference on Ports, Waterways, and International Trade, held in Duluth, Minnesota, in July 1999, highlighted the Great Lakes/Seaway portion of the marine transportation system. The conference, which attracted more than 150 attendees from across the United States,

included sessions addressing services and facilities on the Great Lakes; intermodal terminal developments in nonurban areas; border and trade corridor developments; marine environmental issues, such as ballast water exchange, sediments, and ship propulsion emissions; and a benefit analysis of inland waterway system improvements.

Aviation

The conflict in the aviation sector between growing demand and constrained capacity continues. Demand at all levels, including cargo, continues to increase, while the capacity side faces a host of obstacles, including, among others, funding, environmental concerns, land use, systems and technology integration, and federal/state/local regulations.

The unpredictable flow of Airport Improvement Program (AIP) funds remains problematic, particularly for state aviation planners. Even those states with relatively predictable funding streams must be highly creative in adjusting programs to meet their needs and to use efficiently whatever AIP monies they eventually receive. In many respects, the exercise has been a challenging and frustrating one for both the Federal Aviation Administration and the state aviation authorities.

New airports, along with expanded facilities such as Ronald Reagan Washington National Airport near Washington, D.C., are helping to meet increased demand for air travel.

The states have tried various innovative approaches to deal with this situation. One such measure involved changing the ratio of local–federal funding—increasing local matching requirements from 10 to 25 percent. Another state applied the concept of buying in bulk, acquiring 16 Automated Weather Observing Stations at a unit price of $48,000 instead of paying for them individually at $53,000 each. In this case, one large state made the deal, but the potential for regional coalitions in effecting such purchases is obvious.

Another approach involves working more closely with the state's highway agencies and industries to use readily available paving resources for aviation purposes. Runway, ramp, and taxiway repair and rehabilitation needs can sometimes be met through the use of highway materials and processes. Some states are working closely with FAA to revise overly stringent specifications for aviation facility surfacing materials when highway specifications would be adequate and substantially less expensive. Another, related challenge is finding the time and people—both federal and state planners and engineers—to review and eliminate unnecessarily high standards that have been on the books for decades.

Commercial aviation, including major and regional airlines and business aviation, is still doing extremely well. In the seventh straight year of traffic growth, a number of major airlines reported record income, although their progress is not all blue skies, sunshine, and fair winds. Some forecasts predict a cyclical peak approaching, and ongoing labor disputes could adversely affect profits. A recent TRB report on competition in the U.S. domestic airline industry (*6*) suggests that consolidation does not at this point threaten competition, but that some changes are needed to address public concerns and potential problems. Among other things, the report is critical of slot controls and "perimeter" rules, and notes the need for federal (and other) investment in expanding airport and airspace capacity.

Regional jets are becoming widely accepted by consumers and are having a major impact on the industry. The regional airlines' investment in jets appears to be complementing rather than replacing larger-jet service and is improving overall levels of service to some poorly served communities. At the same time, regional jets are blurring some traditional lines between regional and major carriers, and bringing new issues to the table with regard to crew compensation and operational inte-

gration with the airlines' major partners. Some visionaries extrapolate this trend a decade or two ahead and foresee relatively small jets carrying several passengers as an important complement to the air transportation system. The prospect is seen as both reducing hublock and opening underutilized areas of the national airspace system.

This view coincides with a National Aeronautics and Space Administration/FAA/industry concept, the Small Aircraft Transportation System (SATS). SATS is based on a new generation of personal aircraft, both propeller and eventually jet driven, that would effectively, efficiently, and competitively cover distances at four times the door-to-door speed of highway travel, thereby creating new economic opportunities in the gap between the current limits of highway travel and the commercial air transport system. The concept calls for this capability to be available to more than three–quarters of the nation's population in the first quarter of the 21st century. SATS is seen as both revitalizing smaller airports and the communities they serve, and relieving congestion at the major terminals. Many of the critical technical issues involved have been addressed, and attention is now being focused on the supporting physical and political infrastructure needed to make the concept a reality. A TRB policy study committee is being formed to provide guidance to NASA and FAA on these issues.

SATS raises many questions from the perspective of state aviation. While the concept offers a number of unique opportunities, it raises as many questions—particularly concerning funding. The concept has tremendous appeal and could bring an aviation renaissance to many communities. However, with numerous existing state aviation programs already being woefully underfunded, there is concern about the potential for further dilution of existing funds. Some states are entering the early planning stages for SATS; others are just now beginning to examine the concept, and are asking important questions about its technical, fiscal, and political feasibility.

With demand for air travel increasing more rapidly than improvements in airport and airspace capacity, conflicts are expected, and indeed are occurring. Travelers' complaints have received congressional attention and highlighted conflicting elements in the system, including increasingly competitive efficiencies sought by airline management; rising passenger perceptions of airline indifference; and FAA's difficulty in balancing internal budget and management issues with external pressures for increased capacity, particularly at crunch points such as hubs. These conflicting elements, moreover, exist within a context characterized by demand for magnitude improvements in safety and a Congress variously viewed as over- or underreacting to political pressures applied by the various actors.

Business and general aviation have profited from the strong U.S. economy during the past year. Business aircraft sales reached all-time highs, and production is committed for the next 12 to 18 months. Fractional ownership programs dominate

Airport congestion is a major concern of state transportation planners.

sales, yet still represent less than one-fifth of the industry's production.

Concern continues with regard to declining levels of investment in R&D on both the military and civil sides of the industry, and just what this decline may mean for traditional U.S. technological prowess in the coming decades. There is a strong belief that the nation is currently resting on its laurels—content to profit from research investments made during the 1960s and 1970s—and that the current decline in aviation R&D will have a negative effect on the nation's ability to compete in the future.

Transit

A strong national economy, TEA-21, and forward-looking transit operators suggest the start of a highly positive era for transit. In the first year of TEA-21 (fiscal year 1999), the $5.4 billion federal investment in transit created an estimated 160,000 jobs and stimulated an additional $5 billion in state and local investment. Construction now under way (from all sources of funding) is impressive: 179 miles of bus fixed guideways and high-occupancy vehicle facilities, 191 miles of commuter rail lines, 63 miles of light rail, 43 miles of heavy rail, and 8 miles of trolley bus lines. Between 1997 and 1998, transit ridership increased by 4.6 percent. Plans are now being made to provide new and expanded services to 8 million carless households.

Underlying the above statistics is a growing sense within and outside the transit community that transit has an important role in supporting the general concept of mobility, whether it be in traditionally served central cities, difficult-to-reach suburban locations, or rural areas. Clearly, frustration with urban traffic congestion is forcing many to reconsider how transit should be viewed.

There are some indications that urban sprawl, congestion, transit-oriented development, and smart-growth issues have attained increased political visibility at the national level. Much of the interest in transit as a potential solution is driven by local headlines regarding road rage, speeding, accidents, and traffic jams. At the least, a new context for transit may result. Yet there may also be unrealistic expectations (and thus disillusionment) in some locales unless automobile drivers freely elect to use transit, as opposed to feeling coerced by public policy.

Such macro-level issues represent a top-down, intergovernmental perspective on transit. There is, however, a very dynamic, bottom-up perspective as well:

- In New York City, NYC Transit will install a Communications-Based Train Control System. During the next 20 years, 722 miles of track and 6,000 cars will be modified for the system's wireless train control technology. The first phase of the project alone is valued at $3 billion.
- Operators of rail transit (including commuter rail) are working to provide intermodal connections to sports facilities. Those responsible for transportation in national parks (e.g., the Grand Canyon) are seriously considering light rail transit as an option before committing to expansion of the road/parking infrastructure.
- Bus transit operators are experimenting with bus rapid transit (BRT). In some locations, existing service will be expanded, and in others new facilities and services will be tested. A federal program to demonstrate BRT includes participants from Boston, Massachusetts; Charlotte, North Carolina; Cleveland, Ohio; Dulles Corridor, Virginia; Eugene–Springfield, Oregon; Hartford–New Britain, Connecticut; Honolulu, Hawaii; Miami, Florida; San Juan, Puerto Rico; and Santa Clara, California.
- The San Francisco Bay Area (Metropolitan Transportation Commission) will soon employ smartcards in a coordinated electronic fare and transfer system among 27 transit operators. Other recently installed smartcard systems, in the New York City transit system and in the New York metropolitan area (EZ-Pass tollways and bridges), have been well received.
- Metropolitan and regional coordination agencies will be interested in the approach taken by the Georgia Regional Transportation Authority, which has comprehensive authority to review and recommend highway and transit projects for the Atlanta metropolitan area.
- Local financial support for transit is increasing. Illinois FIRST (Fund for Infrastructure, Roads, Schools, and Transit) is a 5-year, $12 billion program funded by increased state vehicle registration and other fees. Developed by the legislature and the governor, Illinois FIRST was approved in May 1999 and will allocate $4.1 billion to transit. On the other hand, Miami-Dade County, Florida, planned a 90-mile expansion of the regional Metrorail system, which was presented unsuccessfully to voters in July 1999. A proposal for light rail transit in Phoenix in 1998 was narrowly rejected.

Perhaps representing a paradigm shift are several programs now under development at the local community and neighborhood levels. The mobility needs of many citizens (young, elderly, disabled, carless, or unemployed) may sometimes be

at odds with what existing infrastructure-intensive services can offer. Means of making the system fit the needs of the people are, in effect, what nonprofit local organizations are testing. At transit stations, station cars (small battery-powered electric cars for short trips) and car sharing (groups of people paying a subscription plus a per-use fee) hold promise. For the elderly, community-based groups are organizing networks of volunteer drivers to provide essential mobility (see article by Freund in this issue). Some groups own vans; other groups use the vehicles of volunteers, while still others offer a tax deduction for the donation of a used car (and then recondition the vehicle).

Within the transit research community, many organizations are making their information resources and publications freely accessible on the web. TRB posts its transit newsletters, conference announcements, and research reports, including the first edition of the *Transit Capacity and Quality of Service Manual*, on its website (www4.national-academies.org/trb/onlinepubs. nsf; for *Transit Capacity and Quality of Service Manual*, use links to Cooperative Research Program Publications and Web Documents).

In sum, this has been a year in which TEA-21 undoubtedly has helped transit. However, the action has been at the level of the local operator.

Rail

Increased volume but no increase in revenue was the story for the U.S. freight railroad industry in 1998. Ton-miles for the Class I railroads increased by 2.1 percent to 1.38 trillion, another record. Tonnage and carloadings increased by 4.0 and 2.8 percent, respectively, while U.S. railroads hauled a record 8.8 million trailers and containers in intermodal service. Despite the volume growth, however, competitive conditions resulted in little change in Class I railroad revenue: a slight increase in operating revenue was more than offset by somewhat higher operating expenses, so that net income declined.

Extraordinary capital expenditures also characterized 1998 as Class I railroads spent $7.2 billion on new equipment, roadway, and structures—an increase of 15 percent over the record of 1997. Class I railroads installed 889 new locomotives and nearly 14,000 new freight cars. A total of more than 75,000 new freight cars were added to the U.S. fleet as railroads, shippers, and leasing companies (including a major leasing company owned by the railroads) installed more freight cars than in any year since 1980.

Complementing these capital expenditures to enhance customer service was a large outreach effort initiated by the Association of American Railroads. In an effort to improve service, a forum was created for discussion and problem solving, in which approximately 680 railroad customers were joined by officials of railroads of all sizes; port authority officials; and representatives of federal, state, and local government agencies. Beginning in January 1999, at the request of rail customers, each Class I railroad made available over the Internet weekly performance measures pertaining to operating efficiency.

As in most other industries, mergers, acquisitions, and the sale of property occurred as rail carriers continued their efforts to enhance productivity and service. The acquisition of Conrail by CSX Corporation and Norfolk Southern Corporation was effective in June 1999. Although most of the Conrail operations were absorbed by the other two carriers, three separate shared-asset areas remain under Conrail's control, with Conrail acting as a switching and terminal agent connecting to both CSX and Norfolk Southern. Some areas now have competitive rail services where no service had existed for decades. Because of the service disruptions that followed the purchase of Conrail, intended gains in productivity and reductions in operating costs have not been achieved as quickly as planned. On the other hand, new traffic flows will be realized in some areas where longer, single-carrier routes now make rail more competitive with other modes.

Another major change in the North American rail industry occurred when Canadian National Railway, given Surface Transportation Board authority in May 1999, acquired control of Illinois Central, a U.S. Class I railroad, and the two railroads merged in July 1999. In addition, about a dozen new U.S. railroads began operations in 1998, in part as a result of line sales by larger railroads. Thus the total number of operating U.S. freight railroads increased to approximately 560.

State concerns about freight railroads relate directly to the economic impacts of railroad actions on shippers and their communities. Some of these concerns have been directly related to railroad mergers and the resulting competition and service quality. A number of states make substantial investments each year to help preserve rail freight services (particularly short-line and region-

The U.S. freight railroad industry saw increased volume but decreased revenue in 1998.

al railroads) in order to support local economies. Intended to improve productivity, the transition of Class I railroads to heavier freight cars (286,000 lb) has serious operational and financial implications for many short lines and regionals, as well as the state DOTs that support them. The infrastructure of smaller railroads is often inadequate to handle these heavier loads, and capital to perform upgrades is limited.

Grade-crossing safety remains a critical issue for the U.S. railroad industry. Iowa is experimenting with wayside automated horns at crossings to reduce neighborhood noise impacts while maintaining safety.

Issues related to intercity rail passenger service remain high on the agendas of many state DOTs. State policies and investments are closely linked to the future of Amtrak, which is still striving to meet the congressional mandate of financial self-sufficiency by 2003. One key to future viability—the financial benefits expected from the introduction of new high-speed trains (the Acela service) in the Northeast Corridor—will not be realized until mid-2000. Other improvements to the Northeast Corridor, including the recent electrification of the New Haven–Boston portion, will also help reduce trip times. A number of individual states, including California, Washington, and New York, to name a few, have formed partnerships with Amtrak to improve existing services and develop "incremental" high-speed rail service. A major collaborative effort under way is the Midwest Regional Rail Initiative, involving nine state DOTs, Amtrak, and the Federal Railroad Administration. This initiative envisions a 3,000-route-mile rail passenger system radiating from a hub in Chicago, with enhanced and more frequent services as a result of incremental improvements.

Prospects for "true" high-speed rail on dedicated lines were diminished when Florida cancelled its FOX project earlier this year. California is still considering the feasibility of dedicated high-speed services, although financing of such services remains a major issue. As an enhancement of existing services, Florida is planning a major intermodal passenger facility at Miami International

Airport, which would serve as a hub to link Amtrak, rail transit, highway, and air services.

Grade-crossing safety issues remain paramount in most states. Iowa, for example, is experimenting with wayside automated horns at crossings to reduce neighborhood noise impacts while maintaining safety. Many Midwestern states continue to deal with safety issues and delays for automobile and pedestrian traffic at crossings on heavily used railroad mainlines. The desires of state DOTs to close crossings are complicated by political difficulties in obtaining local support for closures, as well as limited funds for such projects. The dramatic growth in freight traffic, including movement of coal from the Powder River Basin, is expected to continue—good news for the railroads and a challenge for communities and public agencies.

Highways

Design

"Context-sensitive design" is an increasingly popular term, used to indicate a shift in focus toward sensitivity to the context of the surrounding community in the design of a facility. Early and continuous involvement of stakeholders plays a large role in efforts to realize this concept, which is directly linked to interest promoted by the 1997 publication of the FHWA document *Flexibility in Highway Design (7)*. Several states are seeking the relaxation of strict standards in the AASHTO Green Book, especially on lower-volume roadways (*8*).

The profession is moving toward pavement design based on mechanistic principles, calibrated with local empirical data. The Strategic Highway Research Program database on long-term pavement performance and information from the states' pavement management systems enable not only calibration of analytical tools, but also improved prediction of pavement performance.

Emphasis continues to be given to design for rehabilitation, instead of new pavements on new alignments. Rapid, automated, nondestructive testing of pavement surface condition, structural support, and thickness is essential. There is considerable interest among the states in NCHRP Project 1-37, Development of the 2002 Guide for the Design of New and Rehabilitated Pavement Structures, which has the objective of producing a revised AASHTO guide for pavement design by 2002.

A continuing trend is toward outsourcing of design work to the private sector, often accompanied by (or as a result of) agency staff reductions. States report concern about quality control of the vast amount of work being done by consultants. There is also an emphasis on design–build projects. Some states may not use this approach because of legal restrictions, but many of those able to do so have already let such projects.

Bridges are increasingly being designed using the Load and Resistance Factor Design (LRFD) specifications developed under an NCHRP Project and adopted by AASHTO's Highway Subcommittee on Bridges and Structures. Computer programs that facilitate LRFD design are becoming available and continue to be improved. In addition, 3-D visualization is playing a growing role in bridge design. Scour susceptibility and mitigation techniques at bridge piers and foundations are receiving considerable attention as well.

Many states are using NCHRP Report 350, *Recommended Procedures for the Safety Performance Evaluation of Highway Features (9)*, in selecting new roadside safety appurtenances. However, there is concern about the magnitude of the upgrade effort, legal issues, and possible future revisions to the recommended procedures. International harmonization of testing and evaluation procedures for roadside safety features is being pursued by FHWA.

The current trend is definitely away from the use of metric (SI) units and back to English units. Some state legislatures have even passed local laws directing the agencies to continue to use the latter units. Often this situation has resulted from resistance by contractors to the use of metric units. Some states, however, have elected to proceed with adoption of metric units for plans and specifications.

Materials and Construction

Materials and construction engineers in state transportation agencies face many complex challenges. This situation will continue for some time, as solutions to the majority of these challenges are not short term. Most if not all of these challenges can be attributed to the tremendous task of reconstructing the nation's aging transportation infrastructure, in many cases under high traffic volumes, with a diminishing trained and experienced workforce.

Construction engineers are striving to reconstruct existing highways and bridges with a minimum of annoyance and delays to the traveling public. To this end, states are considering and using contracting techniques that promote earlier project completion. For example, cost-plus-time bidding has now been tried by approximately 80 percent of all states and has become a routine contracting procedure on appropriate projects among some states.

States are experimenting with cost-plus-time bidding to promote earlier completion of highway and bridge projects.

Nighttime construction to avoid peak traffic periods is also used by some states in heavily congested areas. For example, most asphalt resurfacing work contracted by the Maryland State Highway Administration on high-volume highways is performed at night. Other states are considering increased use of nighttime construction as their traffic volumes continue to increase. The recently published NCHRP Synthesis of Highway Practice 218, *Mitigation of Nighttime Construction Noise, Vibrations, and Other Nuisances (10)*, provides important guidance for those implementing this approach.

States also recognize that construction delays exacerbate inconvenience to the traveling public, and are considering constructibility reviews to mitigate the causes of delays. However, most states cite a shortage of staff resources as an impediment to undertaking such reviews.

Since most current projects are now carried out under traffic, and this situation is expected to continue, state materials and construction engineers are pursuing the construction of more durable (longer-lasting) highways and bridges to mitigate future inconvenience to the traveling public. The promise of more durable infrastructure is offered by the use of Superpave® (a binder specification and asphalt mixture design process) for asphalt pavements, high-performance concrete for structures and pavements, and high-performance steel for structures.

Although Superpave protocols are continually being refined, most states are maintaining the schedule for Superpave implementation. Fewer than five states will not have implemented the binder specifications by 2000; the number of projects using the mixture specifications has doubled nationally in the past year, and the majority of states plan to implement these specifications by 2000. New York State DOT, one of the lead states for Superpave implementation, used the specifications for all of its asphalt paving projects in 1999.

Recent increases in funding for federal, state, and local transportation construction have begun to address the needs of the nation's aging infrastructure. At the same time, however, the growth in funding has magnified the challenge for state DOTs, as well as the contracting and consulting industry, to develop and maintain the workforce needed to accomplish the work at a time when there is a general shortage of qualified candidates for employment.

Soils, Geology, and Foundations

In 1997–1998, the wet season due to El Niño was responsible for numerous rockfalls and landslides along highway corridors in Pacific Coast states. In 1998–1999, La Niña caused numerous rockfalls, landslides, and debris flows, particularly in Washington State. A pooled-fund study, with Oregon DOT as lead, is developing design criteria for construction of roadside ditches that can serve as catch areas for rocks that roll down the slopes along highway corridors. Work on this project is progressing well, and the results are to

be released in late 2000. Another pooled-fund study is being initiated, with Washington State DOT as lead, to develop design criteria for wire and cable mesh used as drapes on rock slopes to mitigate rockfall hazards. This study is also expected to investigate the design of anchors for use in installing the mesh.

Compaction of subgrade, subbase, and base courses for roadways, as well as of fill material in embankments, has emerged as a serious problem. Inadequate compaction results in roadway roughness and slope stability problems. Existing specifications on compaction are considered inadequate for quality control. Research is under way in some states to address this inadequacy.

Environmental concerns related to transportation activities are affecting projects of many state DOTs. The Endangered Species Act has resulted in major challenges for state geotechnical engineers and geologists. For example, riprap is the most commonly used erosion control method along stream banks, and is also used for scour protection of bridge foundations. Rulings under the Endangered Species Act have raised concerns about the effect on aquatic life of fine material from riprap that enters the water. Some states are considering alternative approaches, such as bioengineering. Moreover, stream beds are frequently a source of good aggregate, and there is concern that rulings under the Endangered Species Act could affect production from such areas.

Approximately 20 percent of the states have implemented LRFD for foundation design, while many other states plan to do so in the near future. In general, state DOTs' implementation of LRFD for structural design is far ahead of that for geotechnical design. There is also very little experience with the use of LRFD for slope stability, earth-retaining structures, or culverts.

States generally do not allow use of dredged materials for pavement subbase. However, about 20 percent of the states allow use of dredged granular material, such as sand, for embankment fill material provided it meets the same standards as crushed quarry or pit run material.

Approximately 25 percent of the states are using a computerized database for boring log information, which is generally employed for geotechnical reconnaissance work. Because of the variability in subsurface conditions, most states do not use the information in this database for preparing generalized maps. States are also making greater use of electronic communication by posting manuals (such as the soil testing manual) and specifications on their intranet, as well as on the Internet.

Finally, about 25 percent of the states have had some experience in using cone penetration testing for subsurface characterization. However, only 10 percent of the states use this type of testing routinely.

Maintenance

Areas of concern and improvement in transportation maintenance include work zone safety; maintenance management; effective utilization of contract resources; integration of environmental concerns into maintenance operations; and implementation of new technologies, materials, and procedures.

Safety for the traveling public and for contractor and agency workers remains a high priority for transportation organizations. Several DOTs are investigating the use of new technologies to provide real-time information to drivers, exploring ways to improve the safety of nighttime operations, and implementing the work zone appurtenance requirements set forth in NCHRP Report 350, *Recommended Procedures for the Safety Performance Evaluation of Highway Features (9)*. Excessive speeds and aggressive driver behavior continue to hamper efforts to make construction and maintenance work areas safer.

Several states are involved in efforts to develop and implement maintenance management systems, using advanced technologies to record the condition of assets and forecast workloads within the context of asset management. Personal computers are being used by more field units to input maintenance activity data, access data in agency databases and road weather information systems, and provide information on roadway conditions and weather to the public via the Internet.

There is an increasing trend toward maintenance of the roadway network with fewer agency employees and increased contractor support. Contracting of maintenance activities is being accomplished through managed outsourcing and area maintenance contracts. Managed outsourcing is tailored to contracts with the DOT identifying when and where work is to be accomplished. Area maintenance contracts are typically multiyear lump-sum contracts covering most, if not all, of the roadway maintenance activities on a designated route or in one or more geographic areas. The contractor is responsible for determining what maintenance is required and when the roadway elements are in compliance with operational standards or levels of service. Agency personnel

inspect for compliance, sometimes using quality assurance techniques based on statistical samples. Most area maintenance contracts contain risk-sharing mechanisms based on average workloads; many allow subcontracting of up to 50 percent of the work, with several recent contracts allowing up to 70 percent.

A number of agencies have expressed interest in environmental maintenance issues, including winter operations, vegetation management and litter control, bridge maintenance, pavement sweepings and marking materials, vehicle maintenance, storm water runoff, and environmental awareness training. An excellent source of information in this area is NCHRP Synthesis of Highway Practice 272, *Best Management Practices for Environmental Issues Related to Highway and Street Maintenance (11)*.

The introduction of new technologies, materials, and procedures is changing the way maintenance activities are accomplished. In the structures area, a number of states are automating their bridge inspection program using portable computers and digital cameras for field data entry, and are working toward digitizing their bridge plans. Several agencies are exploring the feasibility of employing instrumented structures to measure bridge performance using finite-element modeling. As this work on "smart structures" progresses, it is envisioned that bridge inspection will shift from visual inspection and condition rating to quantitative assessment of bridge performance and conditions. Several agencies also report increased use of bonded carbon fiber-reinforced plastic laminates for aging or damaged beams to supplement or restore load-carrying capacity.

In the pavement area, states are exploring the use of preventive maintenance strategies to reduce costs and increase the time before rehabilitation or repair is needed. The experience of several DOTs indicates that preventive pavement maintenance activities conducted at the appropriate time can result in a sixfold reduction in rehabilitation costs.

With regard to winter services, many agencies are successfully maintaining a high level of service on the roadway network during storm events by using anti-icing techniques to prevent the bond between snowpack and the pavement surface from forming and to maintain acceptable surface friction. One state is considering the use of road weather information systems together with automated vehicle location systems in wargaming scenarios to investigate the effectiveness and efficiency of snow removal operations as part of a "total storm management" approach to winter services. A number of states have installed and are evaluating the use of automatic anti-icing systems on bridge decks. In addition, as noted earlier, several agencies are providing public access to weather information on the Internet to improve trip decisions. The University of Iowa is operating a Listserv (e-mail based) service through which several hundred subscribers from around the world conduct discussions on topics related to winter maintenance (owner-snow-ice@list.uiowa.edu).

While progress is being made in the development and implementation of new technologies, materials, and procedures, challenges remain. In the structures area, topics of concern include worker health issues related to structural steel lead paints, quick deck replacement technology, bridge construction and repair under traffic, innovative nondestructive testing methods, and automated methods for gathering and managing data. While the preventive pavement maintenance approach provides a strong incentive to switch from a reactionary to a preventive program, research is needed to aid agencies in determining when and what preventive treatments should be applied.

Traffic Operations

Many issues facing transportation professionals today manifest themselves in the area of traffic operations. Increasing traffic congestion and changing driver behavior, coupled with ITS deployment and the development of automated highway systems, make traffic operations a challenging arena.

Half of the urban freeways in the United States are operating at or above capacity during peak hours. To compensate, drivers are modifying their driving patterns and behavior. For example, many people are leaving for work earlier or later. Thus there is no longer a peak hour, but ever-expanding peak hours. In many areas of the country it is not unusual to find the morning rush hour beginning before 6:00 a.m. and extending to 10:00 a.m., only to be repeated for a similar period in the evening. As a result, it is increasingly difficult to find times of the day when the nation's highways are not congested.

Many drivers, frustrated with this increasing traffic congestion, are becoming more aggressive in their driving behavior—speeding, tailgating, and making abrupt lane changes. The term "road rage" has emerged to describe the more extreme aspects of this driving behavior, which has been associated with a number of traffic fatalities. In an attempt to remedy the situation, public agencies are implementing various countermeasures,

including public information campaigns, enforcement targeted at the aggressive driver (such as telephone hotlines and photo enforcement), and roadway design modifications to "calm" traffic.

Photo enforcement of red light runners and speeders has been used for many years in a number of European countries and Australia. Recently, some U.S. communities have implemented photo enforcement, primarily for red light running. This technology makes it possible to detect traffic violations without the actual presence of a law enforcement officer. Evaluation of such systems has shown them to be effective in deterring violations.

Traffic calming, used in Europe and Australia for many years, has drawn increased attention in the United States as local agencies try to meet citizens' demands to improve traffic control in their neighborhoods. Traffic calming typically refers to a variety of physical features placed within the roadway to reduce vehicle speeds and encourage more acceptable driver behavior. Among the measures commonly used are speed humps, chicanes, chokers, and small traffic circles. Advocates of traffic calming measures frequently cite the benefits of improving the safety and quality of life in residential areas; opponents express concern about increased emergency vehicle response times, snow removal, and the potential for liability exposure.

Roundabouts are another approach used extensively elsewhere in the world that has recently attracted considerable interest in the United States. The modern roundabout has been used successfully in a number of areas to replace signalized intersections and diamond interchanges. When selected and designed properly, roundabouts have proven effective in reducing delays and improving safety.

For some time, industry, academia, and government have been conducting research on the use of vehicle automation to improve traffic flow and prevent crashes. This research has included in-vehicle information systems, automated highway systems, and crash avoidance systems. Research has demonstrated that intelligent vehicle control technology has the potential to offer major improvements in safety and efficiency for existing highways. The current Intelligent Vehicle Initiative has consolidated these efforts into one government–industry–academia collaboration aimed at applying computer, communications, and vehicle control technologies to the vehicle–highway system.

Value pricing concepts provide an approach for better utilization of the capacity of HOV lanes or for implementation of congestion pricing. The value pricing concept, which has been implemented in the I-15 HOV lanes in San Diego, California, allows drivers to purchase a monthly permit that enables them to buy their way into the dedicated HOV facilities when they do not meet the occupancy requirements. Combining this value pricing concept with electronic toll collection capability provides the opportunity to implement a congestion pricing scheme that can be tied to the level of congestion on a facility.

Another concept being examined is high-occupancy toll lanes. The HOT lane concept, which has been implemented on Route 91 in Orange County, California, allows free access of carpools and vanpools to a toll facility, thus serving as an incentive for car- and vanpool formation.

Speed limits that are changed dynamically to reflect existing conditions are under consideration in some areas for better speed management on freeways. These variable limits can be used to inform motorists of reasonable and safe operating speeds based on real-time traffic speed and flow data, weather conditions, construction or maintenance activities, and other factors. Changes in traffic flow are detected by loop sensors, and appropriately reduced speed limits are displayed to approaching motorists on variable message signs.

As discussed earlier, traffic control practices at highway–rail grade crossings remain a priority as high-profile accidents continue to occur and high-speed passenger rail service is implemented. Some of the major areas of concern are associated with the interconnection between highway and rail signals, signal preemption, vehicle storage between rail track and highway intersections, and provision of adequate clearance. FHWA has issued recommendations related to traffic operations, highlighting the need for consistent terminology and definitions for use by the rail and highway industries, a new traffic signal warrant based on railroad preemption, and guidelines for evaluating and designing safe preemption and interconnection of railroad–highway warning devices and signals.

TRB Special Report 209, *Highway Capacity Manual* (HCM), is one of the most widely used documents in the transportation community (*12*). Translated into several languages, the HCM is the standard reference on which transportation analysts around the world rely for state-of-the-art methods. During 1999 TRB completed a multiyear, multimillion dollar research effort to produce the next edition of the HCM—HCM 2000—funded by AASHTO and FHWA through NCHRP. New research results for freeway weaving, freeway systems, two-lane highways, transit capacity, bicycle

Safety concerns continued to be a leading driver of both new and continuing transportation programs in 1999.

and pedestrian capacity, interchange ramp terminals, and transportation planning procedures will be included, and both paper and multimedia (CD-ROM) formats will be available. It is expected that HCM 2000 will be available by fall 2000 in both metric and U.S. customary units versions; the CD-ROMs are expected to be available by the end of the year.

Safety

Overall, the numbers of deaths on the nation's highways are slowly decreasing as a result of a myriad of safety countermeasures and programs. Highway, vehicle, and driver programs are all contributing to the goal of reducing crashes, deaths, and injuries on the U.S. road system.

During 1998 the effectiveness of highway safety programs in 10 states was assessed by the National Highway Traffic Safety Administration. Federal grant programs were found to be crucial to the initiation of local safety activities. More than 40 percent of the programs in the 10 states would not have started or continued without federal funding. For example, such funding was critical for almost 90 percent of the programs aimed at promoting use of safety belts. The approach of using federal dollars to initiate programs appears to have been successful, since total highway safety spending per capita increased nationally from $35 to $45 (constant 1996 dollars) during a 13-year period, even as federal grants in the same period decreased from $1.54 to $0.59 per capita.

According to the NHTSA assessment, programs funded by federal grants appear to have direct safety benefits. During the 1980–1993 period, alcohol-involved crash fatalities in the 10 states decreased from 23,000 to 17,461, safety belt use increased from 12 to 65 percent, motorcycle fatalities were reduced from 5,144 to 2,449 as graduates of motorcycle rider training increased sevenfold, and pedestrian and bicycle fatalities declined from 8,070 to 5,649.

Special traffic enforcement programs aimed at occupant protection were evaluated in 20 states. States with standard (primary) safety belt laws benefited from these programs more than states with secondary safety belt laws, with a 16.8 versus a 5.6 percentage point gain in safety belt use. During 1999, large-scale enforcement, accompanied by public information and education campaigns organized by the Air Bag Coalition, resulted in significant increases in safety belt use for the participating jurisdictions.

A growing number of states are adopting graduated licensing programs. Interest continues in training and education of drivers as a component of these programs. In March 1999 the Ontario Ministry of Transportation conducted an electronic conference on novice driver training and performance, cosponsored by TRB. More than 385 individuals registered for the conference, and engaged authors of submitted papers and each other in discussion. The conference format allowed researchers and practitioners from around the world to "attend" at little or no cost.

As more states lowered their legal blood alcohol content (BAC) level to 0.08 percent, a major law enforcement tool—the Standardized Field Sobriety Test—came under increased scrutiny. An assessment conducted by the San Diego Police Department revealed that the test is fully valid and acceptable for field use in determining probable cause for arrest for driving while intoxicated. The test was found to discriminate at or above 0.04 BAC.

During 1999 FHWA released its *Older Driver Highway Design Handbook (13)*. This handbook is based on a multiyear, high-priority research program conducted by the agency. The handbook includes specific design options to aid older drivers. For example, left-turning movements at intersections are associated with significant numbers of crashes involving these drivers. A relatively small left-turn bay offset improves the ability of older drivers to see oncoming traffic and reduces such crashes. FHWA is conducting workshops nation-

wide to introduce the handbook to state and local designers and officials.

Speed continues to be a major factor in crashes on the nation's streets and highways. The estimated annual economic cost of speeding-related crashes is $27.7 billion (in 1994 dollars). While there may be a sense among drivers that actual speeds on Interstates have risen more than speed limits, only 14 percent of speeding-related fatalities occur on Interstate highways. Technologies such as variable speed limit signing and design techniques such as traffic calming are the most recent approaches to speed control. (*14*)

In May 1999 the third 3-D in Transportation conference was held in Orlando, Florida. In discussing these rapidly advancing technologies, participants focused on the decreasing cost and increasing ease of use of visualization software. Also of major interest were the growing number of success stories and the cost, engineering, and public relations benefits reported from using 3-D in project planning, design, and public outreach. The conference host, the Florida Department of Transportation, produced a CD-ROM containing the conference proceedings, which is available at no charge from FDOT or TRB (call 202-334-3213 and request the 3-D in Transportation Proceedings CD-ROM).

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