TRANSPORTATION OUTLOOK

TRB's Field Visit Program 1993–1994

Each year Transportation Research Board staff members visit every state highway and transportation department, many universities, transit and other modal agencies, and industry representatives. The objectives of the field visit program are to (*a*) learn of problems facing the visited organization and to pass on information pertinent to the solution of these problems (information that is based on research or the experiences of other states, industry, or educational institutions); (*b*) learn of research activities in progress or contemplated in order to inform the visited organization of similar research being carried out elsewhere, thus preventing duplication of efforts; and (*c*) identify new methods and procedures that might have application elsewhere.

Overview

Federal, state, and local governments continue to work their way through the requirements of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and the Clean Air Act Amendments of 1990 (CAAA). Establishing the management systems required by ISTEA has demanded much attention and effort, and the operational status of these systems varies from state to state. System integration is a high priority to allow the individual systems to interact and share data bases. Public participation in the planning process has gained in importance as a result of the planning regulations issued by the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA).

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Choctawhatchee Mid-Bay Bridge, Okaloosa County, Florida

Interpretations of the CAAA provisions by the Environmental Protection Agency (EPA) have caused much concern, and the conformity requirements have placed potentially severe limitations on urban highway construction programs. Greater emphasis is being given to implementing steps to reduce air pollution (e.g., development of alternative fuel vehicles), but the total benefit expected from these steps is not expected to satisfy the air quality requirements in the near future.

Intermodalism is a common goal of most transportation professionals, and all government levels are actively redesigning their programs to support the concept. The private sector is equally committed to improving transportation efficiency through intermodal applications. However, events such as the 1994 Teamsters' strike concerning the most efficient mode for a given trip indicate that intermodalism is not easily attained. A significant step toward intermodalism will be the designation of the planned National Transportation System. The National Highway System has been developed by the states and FHWA and submitted to Congress for approval.

Congestion continues to be a major concern. Congestion pricing, high-occupancy vehicle (HOV) lanes, intelligent vehicle-highway systems (IVHS) applications, greater use of light rail transit, and numerous other congestion-reduction strategies are receiving considerable attention. Debate over the effectiveness of some of these programs is ongoing; for example, some claim that IVHS programs will actually be counterproductive from an environmental perspective in that more travel will be encouraged.

Implementation of high-occupancy vehicle lanes is one approach states are employing to use freeways more efficiently.

Many noteworthy transportation challenges occurred during the past year: the devastating flood in the Midwest, the California earthquake and fires, and the severe winter combined to make it a demanding year for transportation providers. Proposals to create a new organization to take over the air traffic control responsibility of the Federal Aviation Administration (FAA), significant changes in the makeup of the airline industry, delays in opening the first new major airport in many years, and serious problems facing the nation's ports over dredging issues indicate that not all the challenges are on the ground.

Planning

Almost two years after the signing of ISTEA, the final regulations have been published governing statewide and metropolitan planning. Included are conformity regulations addressing the linkage of transportation and air quality plans. Interim rules that detail how to develop and implement the ISTEA-required management systems have also been developed.

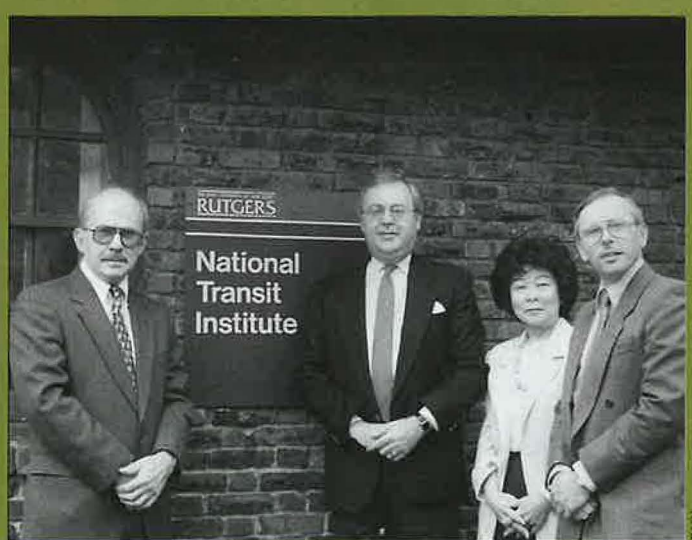
The new regulations, jointly issued by FHWA and FTA, offer clarification on several key aspects of the law, including finance, state and metropolitan planning organization (MPO) planning procedures, congestion-management system planning, and major investment analysis. States and MPOs had to comply with the regulations by October 1, 1994. Statewide plans, including those for metropolitan areas, are subject to federal approval.

Public participation receives considerable attention in all the regulations. Not only are MPOs and state departments of transportation (DOTs) obliged to involve the public throughout the planning process, they must prepare a plan detailing how they intend to do it and to offer that plan for public examination and comment. Principles of public involvement reflected in the new regulations include (*a*) publishing timely information about transportation issues and processes, (*b*) providing adequate notice of public involvement activities, (*c*) explicitly considering and responding to public input, and (*d*) making special efforts to ascertain the needs of the unserved segments of the public. The new regulations establish cycles for updating plans and programs at both the state and metropolitan levels. The regulations also make explicit some requirements that were implicit in the original act. For example, the regulations call for joint analysis of major transportation investment proposals that integrate the MPO procedures with those of the state DOT, transit operators, and environmental agencies in the region.

The U.S. Department of Transportation (U.S. DOT) recently issued a report, *Regional Roundtable Report and Action Plan: A Progress Report from Our Customers*, summarizing a series of 10 roundtable sessions held across the nation to give state and local officials the opportunity to advise U.S. DOT on planning issues. Ten areas of nationwide concern emerged from these sessions:

1. Support full funding of ISTEA;
2. Simplify the ISTEA project approval process;
3. Oversee the planning and funding allocation process to ensure that it works as intended;
4. Reduce the complexity of ISTEA regulations;
5. Encourage more flexibility and cooperation from EPA in helping communities meet air quality goals;
6. Use transportation planning to maximize system efficiency and support economic development;
7. Expand ISTEA outreach and training;
8. Increase the priority for freight projects;
9. Give rural areas a fair share in the distribution of funds; and
10. Emphasize preservation of the existing transportation system infrastructure.

U.S. DOT and its modal administrations have adopted action plans for each of these issue areas.



TRB meeting at Rutgers University with staff of newly started National Transit Institute. *From left:* Richard Brail, Director Alan Gibbs, Sakae Hata, and Neal Denno.

Finance

For the first time since the late 1980's, Congress has increased the federal gasoline tax (by 4.3 cents) and used the tax for deficit reduction. It is common practice for European and Asian countries to use petroleum-based taxes as general revenue funds, but in the United States both the federal and state governments have created earmarked trust funds to ensure that user revenues are dedicated for transportation purposes. The ability to maintain this integrity of funds is now in question.

In addition, under ISTEA, states have been given substantially greater latitude in the movement of funds between highway and transit projects. States are beginning to transfer funds between highway and transit programs, especially under the Congestion Mitigation and Air Quality programs of ISTEA. This further diminishes the exclusive dedication of user taxes for specific users.

Several factors are affecting fuel tax revenues. With the improved fuel economy of vehicles, fuel tax revenues have not been significantly increasing even though total vehicle miles of travel continue to increase. Air pollution control in urban areas during winter months may require the use of oxygenated fuels that are essentially gasohol (often tax exempt or taxed at a lower rate). The federal 5.4 cent-per-gallon exemption for gasohol has already reduced federal Highway Trust Fund receipts by $4.5 billion. A number of states are considering alternatives to the current fuel taxes, especially in light of the increasing use of alternative fuel vehicles.

Congestion pricing and the imposition of tolls continue to receive attention as techniques to reduce pollution and improve traffic flow; however, there are still major impediments to acceptance of these concepts involving issues of equity, privacy, and the potential impacts on the commercial and land development community. A few pilot projects, such as toll bridges and increased parking fees, are under way and several private toll roads are being constructed in Virginia and in California.

Management and Human Resources

Most states have completed their early retirement programs. New employees have been hired to fill some vacancies, but most DOTs are now working with staffs that are 25 percent smaller than they were in the 1970s. Combined with staff reductions, many states are undertaking major organizational reviews in an effort to improve their efficiency and responsiveness to the public. There is a growing recognition that the construction-oriented organizational structure, under which most DOTs have operated for the past 40 years, is not responsive to the needs of the post-Interstate era. In the foreseeable future, DOTs will continue to employ smaller staffs with greater reliance on contracting out of services. Most DOTs are continuing to decentralize activities and provide greater empowerment to their employees.

In many states, the decision-making processes are being expanded to include not only the public but also other governmental agencies and public interest groups. As a result, decision making is increasingly based on consensus rather than solely on engineering judgment. States have accepted greater management control of their federally funded State Transportation Program, and are also developing formal processes and establishing performance standards for the management systems mandated under ISTEA.

Congestion pricing during peak travel times is one technique proposed to help reduce pollution and improve traffic flow.

Environment

Even though automobile emissions have been reduced by more than one-third in the past 10 years and the number of poor air quality days in the 15 largest cities has decreased by more than 40 percent, air quality continues to be the major contention for limiting transportation improvements in urban areas. EPA has interpreted the 1990 CAAA as requiring states to show an actual emissions reduction of 15 percent from the 1990 base, regardless of any population growth or increase in vehicle miles of travel in nonconforming urban areas. All projects submitted under the State Improvement Plan must show a significant reduction in emissions from the cap now in place and for future years. This is known as "conformity." As a result of the conformity requirements, it has become extremely difficult to construct bypasses or expand existing roadway capacity in nonattainment areas.

To meet emission standards, states are enforcing more stringent tailpipe emission standards, using oxygenated fuels during winter months and requiring vapor-recovery systems on gasoline pumps. In addition, they are instituting programs aimed at reducing the demand for single-occupancy automobiles. Two of the major issues concerning air quality are (*a*) the accuracy of air quality models being employed to measure and forecast pollution levels and (*b*) the criteria for the application of sanctions for nonattainment areas. These criteria include the effectiveness of transportation control measures and transportation demand management techniques, relationship of air quality to travel and land use patterns, and accuracy of data. Barring the political

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Rendering of Chesapeake and Delaware Canal Bridge. An AASHTO Subcommittee is considering new bridge design specifications based on approach developed under NCHRP project, Development of a Comprehensive Bridge Specification and Commentary.

MINISTRY OF TRANSPORTATION OF ONTARIO, RESEARCH & DEVELOPMENT BRANCH

During field visit to Ministry of Transportation, Ontario (MTO), Richard Pain, TRB (*left*) examines carbon reinforced plastic grids with George Gera, MTO. Grids are being used by MTO as replacement for steel in bridge deck slabs.

improbability of strong transportation or land-use control measures being applied to nonattainment areas, the strict application of air quality conformity may essentially halt major highway improvements in urban areas where there is nonconformity with the air quality standards.

As a result of air quality concerns, renewed attention is being given to alternative fuel vehicles. A number of states and municipalities are experimenting with the use of liquefied natural gas vehicles. There are plans to introduce electric vehicles into the public sector car fleets, but the future of the electric vehicle as a means of reducing air pollution ultimately depends on the development of a new, lightweight, quick-charging, long-life electric storage battery.

Wetlands mitigation and replacement continues to be a major impediment to the construction of transportation projects. Federal environmental protection policies relating to no-net-loss of wetlands, classification of quality of wetlands, location of replacement wetlands, definition of wetlands, and the permitting processes continue to be major issues to be resolved. On the positive side, wetlands are increasingly being recognized for their ability to filter pollutants.

Design

A continuing emphasis area concerning pavements is the implementation and maintenance of state pavement management systems (PMS). The challenge is to integrate PMS with other management systems to provide information for the decision-making process. The TRB Third International Conference on Managing Pavements, held May 22–26, 1994, in San Antonio, Texas, provided attendees with information on (*a*) ways to ensure that an appropriate PMS is being used, (*b*) how to manage and analyze the data coming into the system, (*c*) methods of dealing with institutional issues surrounding implementation of the system, and (*d*) the future of PMS.

The Strategic Highway Research Program (SHRP) Long-Term Pavement Performance data base is providing information on pavement performance, leading to improved pavement design and rehabilitation techniques for longer pavement life. ASTM has been working on standards for all aspects of the PMS process, and researchers have been expanding the knowledge base of PMS and related technologies. Some areas of research being studied are rapid, automated, nondestructive pavement testing (surface condition, structural support, thickness); mechanistic/empirical pavement design; and data collection, handling, and analysis techniques. Future challenges include incorporation of new equipment, techniques, and philosophies into PMS.

The American Association of State Highway and Transportation Officials' (AASHTO) Highway Subcommittee on Bridges and Structures has adopted new bridge design specifications, developed under NCHRP Project 12-33, Development of a Comprehensive Bridge Specification and Commentary, based on the load and resistance factor design (LRFD) approach. The AASHTO *LRTD Bridge Design Specifications* were recently published, and individual states are currently making decisions on the use of LRFD in their bridge designs. Another aspect of structures that is receiving considerable attention is that of susceptibility to scour. Research efforts are under way to develop expert systems to help in the field investigation of sites, and another research project is focused on nondestructively ascertaining foundation details about which there is little or no information.

The area of roadside safety features continues to be of high interest to the states. Many states are moving toward the use of *NCHRP Report 350, Recommended Procedures for the Safety Performance Evaluation of Highway Features,* which replaced *NCHRP Report 230,* the previous reference on crash testing. Significant efforts have been made toward establishing international harmonization of testing and evaluation procedures for roadside safety features. TRB has issued *Transportation Research Circular 396* on the subject.

Metrication is another major issue for the states. FHWA's plan to comply with the Omnibus Trade and Competitiveness Act of 1988 will lead to the use of metric (SI) units in direct federal and Federal-aid construction contracts by September 30, 1996. AASHTO's Highway Task Force on Metrication is working to bring about a smooth transition to metric. The ASTM Manual E 380-91, *Standard Practice for Use of the International System of Units,* has been adopted as the standard for all federal agencies for conversion to metric. A "metric clearinghouse" has been established at the Texas Transportation Institute under an NCHRP project to assist and share information in this area. TRB now includes metric units in its publications.

Materials and Construction

The use of waste materials and byproducts in highway construction continues to be a major area of experimentation for the state highway agencies. Although some waste materials, such as reclaimed asphalt pavement and coal fly ash, are now almost routinely specified by most state agencies, other waste materials are still being evaluated for their costs and benefits and potential impact on the environment. The use of scrap rubber tires in asphalt pavements continues to dominate the attention of materials engineers and researchers as they strive to assess the value of this waste material for construction purposes.

An increasing number of state agencies are experimenting with stone mastic asphalt (SMA) pavements. This particular type of mixture design was brought to the attention of a group of U.S. pavement specialists who toured Europe in 1990. SMA is used in European countries as a surface layer to resist rutting and abrasion caused by heavy traffic. In the United States highway agencies are evaluating the SMA concept using this country's mix design methodology and construction practices.

State agencies are in the process of implementing the new SHRP binder and mix design specifications. The asphalt binder specifications have already been adopted as provisional specifications by AASHTO, and the mix design (SUPERPAVE) specifications are in the process of being evaluated by the AASHTO Subcommittee on Materials. In addition, some state agencies have received the new SHRP binder and SUPERPAVE testing equipment and others are preparing for the arrival of this equipment during 1995. Some states have already sent technicians to be trained at the National Asphalt Training Center on use of the binder equipment.

More state agencies are moving toward the use of quality control/quality assurance specifications, incorporating incentive and disincentive provisions for quality. Some agencies are satisfied with the basis for their adjustable payment schedules; however, many feel that more research is needed on the relationship between the materials and the construction factors used to control quality and determine acceptance. Research is also needed on the performance and cost of the finished products.

Normal attrition and reduction-in-force programs during the past few years have caused agencies to staff construction projects with younger, less experienced employees. Agencies with large construction programs are supplementing their work force with consultants for construction engineering and inspection. State agencies are continuing to examine the public-private partnering concept on construction projects and to experiment with innovations in contracting practices.

Soils, Geology, and Foundations

Landslide- and rockfall-related repair and maintenance costs to state transportation facilities amount to more than $100 million annually. State transportation agencies need state-of-the-practice information on investigation, mitigation, and control of landslides and rockfalls. This much-needed information will be contained in a TRB Special Report on Landslides: Investigation and Mitigation, to be published early in 1995. This report is the result of a TRB task force effort that has extended over several years.

The number of states that employ devices to test soils in situ using some level of automation to conduct tests and collect data in the laboratory has steadily increased over the years. States have also increased their use of computers and software programs to analyze data.

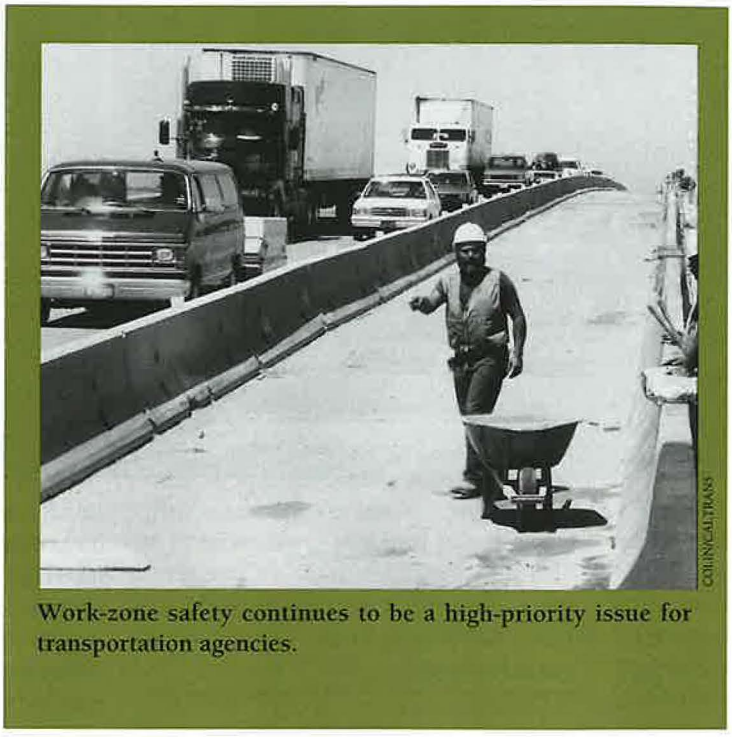
Greater use is being made of unconventional materials (e.g., waste, recycled, or by-product materials), as aggregate, fill material, and stabilizers. Several concerns include (*a*) effects on environmental quality, (*b*) corrosion of metal structural elements (e.g., piles, pipes, and soil reinforcements), and (*c*) methods for properly evaluating these unconventional materials.

Some recent examples of geotechnical applications are soil nailing, auger cast piles, stone columns, and vertical moisture barriers. Vertical moisture barriers, fiber reinforcement, and lime modifications are being used to minimize the damaging effects of expansive soils.

Concrete recycling operation on I-84 in Idaho.

Maintenance

Several states are taking advantage of a unique opportunity to upgrade their maintenance management systems in concert with the development and implementation of the management systems specified in ISTEA. Some management system components being explored are (*a*) computer scheduling of work crews, (*b*) global positioning systems (GPS) to locate maintenance activities, (*c*) geographic information systems (GIS) for storage and retrieval of maintenance information by location, and (*d*) automatic updating of labor, equipment, and materials records. The computer scheduling of work crews is applicable to state forces and contractors; the use of GPS and GIS technologies provide the opportunity to increase the accuracy of locating citizen complaints, patrol noted deficiencies, and work accomplished; and the updating of records with automated systems reduces data entry time and entry errors. Each of these improvements has a positive impact on minimizing the paperwork for field supervisors and improving the accuracy of the management system data.



Work-zone safety continues to be a high-priority issue for transportation agencies.

States are continuing to work with the private sector to assess, clean up, and recycle hazardous materials located at maintenance sites. Some states are nearing completion of a multi-year project to replace underground fuel tanks.

Agencies are modifying their chemical spraying programs in response to environmental concerns. Many of these efforts involve the implementation of roadside vegetation management strategies that are in harmony with natural resources and ecological principles. Removal, containment, and disposal of lead-based paints from bridges continues to have a significant impact on funds available for structure repairs. The application of nondestructive testing (NDE) technologies to assess roadway condition is continuing. Most of the NDE technologies are being used to assess the condition of bridge elements, pavements, and signs and pavement markings. Additional work is needed to tailor the application of these technologies to other maintainable items such as roadside vegetation, drainage structures, and possibly safety appurtenances.

Many agencies are expanding their use of winter roadway weather information systems to optimize maintenance activity. The objective is to reduce costs and, with more timely salt applications, provide a safer roadway. Experiments with anti-icing techniques are showing positive results at preventing ice-roadway surface bonding.

A recent tour by federal, state, local, and university engineers to study winter maintenance technologies in Japan and Austria identified several potential improvements in NaCl prewetting, prewetting equipment, and new plow designs.

Work-zone safety continues to be a high priority for transportation agencies. Several agencies noted their practice of making a work-zone safety kit available for use by small urban and rural agencies. A typical kit contains signs that cost $5,000, which are sold to the local agencies for $1,000 to encourage their use.

The primary issues in equipment maintenance are being driven by tight fiscal constraints and environmental requirements. Included are issues in mechanic training; waste management procedures and systems; alternative fuels; standardization of equipment purchases; and the rehabilitation, purchasing, and leasing of equipment.

Traffic Operations

Many challenges and opportunities confront traffic operations professionals today. Traffic congestion, air quality, ISTEA and its many programs, the CAAA, and the financial and personnel shortages facing most states are causing traffic engineers to seek alternative ways to provide the necessary transportation services.

As a result of the $660 million IVHS program contained in ISTEA, the major research focus in traffic operations for this decade and beyond will be on so-called "smart" cars and highways. IVHS includes a wide range of technologies that can enhance safety and mobility, improve environmental quality, and maximize the use of existing transportation facilities. However, questions are now being raised about the effects of IVHS on air quality. The challengers believe that the result of implementing IVHS systems will be increased traffic, producing more pollution even under improved flow conditions.

Although urban traffic control systems are still not at the level envisioned in IVHS scenarios, gains are being made in many states through the development of advanced traffic management centers (TMCs). TMCs control traffic at the corridor level instead of at the freeway only, using real-time data for the entire area. TMCs include features such as coordinated operation of ramp metering, lane and signal control, changeable message signs, advisory radio, and closed circuit TV.

Traffic congestion resulting from accidents and vehicle breakdowns accounts for more than 60 percent of the delay on our nation's urban freeways. As a result, techniques for freeway incident management are attracting considerable interest in many states and urban areas. Many

areas of the country already have comprehensive incident management programs in place and others are in the process of developing such programs. Existing incident management programs clearly demonstrate that they are cost-effective in reducing traffic congestion, enhancing safety, and improving air quality.

Another approach states are employing to use existing freeways more efficiently is through the implementation of HOV lanes. These restricted-use lanes are an important element of transportation management programs in more than 20 urban areas and are under consideration in many others. In addition, ISTEA provisions provide significant funding incentives for states to implement HOV lanes. It is estimated that by 1995 there will be more than 800 lane-miles of HOV systems in operation.

The aging population is also of concern to traffic operations professionals. General improvements in the design, use, and application of traffic-control devices are being implemented to accommodate the changing driver and pedestrian population. For example, states are (*a*) adjusting pedestrian signal phasing to accommodate slower walking speeds, (*b*) using larger lettering on traffic signs, (*c*) placing street name signs overhead to improve visibility, (*d*) using higher levels of retroreflection or internal illumination to improve sign conspicuity and readability, and (*e*) changing sign placement and spacing to enhance driver performance.

TRB *Special Report 209: Highway Capacity Manual* (HCM) is one of the most widely used documents in the transportation community. HCM contains a collection of procedures and methodologies to analyze the operation of existing and proposed facilities. Translated into several languages, HCM continues to be the standard reference that transportation analysts around the world rely on for state-of-the-art methods. During 1994 TRB will issue a new release of HCM incorporating seven revised chapters. These chapters were developed as a result of research activities funded by FHWA and AASHTO through NCHRP. The revised chapters include changes in analysis procedures for signalized and unsignalized intersections, freeways, ramps, and arterial streets.

Safety

The fatal accident rate for highways generally held steady at 1.8 per 100 million vehicle miles driven in 1992 (compared with 1.7 in 1993). Unfortunately this is attributable to an increase in miles traveled; the actual number of motor vehicle-related deaths actually increased in 1993. Although seat belt and airbag use has increased and alcohol-related fatalities have declined, additional improvement is needed. Other areas are being explored for future research and programmatic emphasis. The subject of compliance with traffic laws and traffic control devices is being extensively discussed. In particular, speed limit compliance on all types of roads is generally acknowledged to be a growing problem. A second area is single-vehicle fatalities. These account for 42 percent of all fatal crashes. Therefore, greater emphasis is being placed on the design of roadside features (e.g., slopes, recovery zones, and guardrails).

The National Highway Traffic Safety Administration (NHTSA) estimated that seat belts saved 34,794 lives from 1983 to 1992 and air bags saved 558 lives in four years. Child restraint use is estimated to have saved 2,061 lives during the last 10 years. Seat belt use is approximately at the 65 percent level—an improvement during the past 10 years—but greater use still has significant payoff potential.

Alcohol-related deaths decreased from 22,084 in 1990 to 17,699 in 1993, a 20 percent reduction seen predominantly among teenagers. Total number of deaths for males dropped 22 percent and for females 16 percent. Although these are significant drops, teenage drinking and driving is still a serious problem. With the law for 21-year age requirement for alcohol purchase passed in all states, future attention will be focused on enforcement, public awareness, and strengthening the existing laws.

Although alcohol is the predominant drug problem in motor vehicle crashes, other drugs are still on the scene. According to NHTSA research, examination of blood specimens of 2,000 fatally injured drivers in seven states found that nonalcoholic drugs were present in approximately 18 percent of that sample. Alcohol was also present in about 66 percent of these cases. A "responsibility analysis" found no evidence that drivers with drugs were more likely to be responsible for crashes than were drug-free drivers. However, the analysis did find that drugs contributed to crash causation when combined with alcohol, even at low blood alcohol content levels. The effects of alcohol and other drugs combined on driving are not well understood but are clearly important. NHTSA has initiated additional research in this area.

Seatbelts are now used by approximately 65 percent of drivers, and greater use would increase safety levels.

As the nation continues to repair and rebuild highways, encountering work zones is a common experience for most drivers. The National Transportation Safety Board, following a study of work-zone accidents, made 10 recommendations for improving work-zone safety. Crash attenuators on shadow and other work-zone trucks,

lap/shoulder belts and headrests in those same trucks, and increased emphasis on enforcement and public information were among the recommendations. Of particular importance to safety management is the recommendation to include a data item in crash reporting to distinguish work-zone crashes, both for workers at the site and the driving public.

The safety management system, along with the other ISTEA management systems, is of great interest to the safety community. The challenge appears not to be in creating new data bases but in deciding how to (*a*) best use a safety management system, (*b*) bring together all interested agencies and organizations into a working collaboration, and (*c*) locate and link the data sources available in a state to support the management system. The challenge of creating this system appears great, but the potential payoff appears far greater.

Transit

This is a dynamic and challenging period for transit. Substantial accomplishments have occurred; however, there are some significant concerns facing the industry. For the most part, progress has been made in the areas of transit-favorable legislation, new and expanded services, application of new technology, and continued development of research.

Proposed federal legislation includes a 22 percent increase in capital funding for transit. Previous federal legislation innovations are being adopted by more transit operators (e.g., employer subsidy of transit vouchers, clean air incentives, and funding flexibility in ISTEA).

Service improvements are significant, especially in rail transit. Twelve cities are seriously considering starting commuter rail services. Three cities are in the engineering phase or are constructing light rail systems. Four are considering installation or upgrading of electric trolley bus systems. Many operators are studying ways to improve feeder service in city and suburban areas. Cleaner emission and energy-conserving power sources are being installed as equipment is replaced.

Technological improvements in fare equipment for rail, bus, and transfers are coming on line, and demonstrations on innovative fare-pricing policies are being conducted. Major experiments are anticipated with low-floor, alternative fuel, and electric battery buses, as are service guarantees to customers (e.g., return of fare if dissatisfied, emergency rides home). Very promising products are now being generated by TRB's newly created Transit Cooperative Research Program, which has completed 12 studies and has more than 70 others in progress.

The transit community has been concerned, however, about several continuing issues. Financial pressure remains and operators have been forced in many areas to raise fares and cut service. Proposed federal subsidies for transit operations are substantially less than in previous years. Some operators fear that increasing capital assistance and decreasing operating support may lead to a financial incentive to buy new equipment at the expense of long-term equipment maintenance. Ridership is dropping overall, yet new services such as commuter rail are increasing ridership.

Of special note is the fact that public safety and personal security are demanding more attention. A major earthquake in Los Angeles demonstrated how useful transit could be when automobile travel is disrupted. Local, state, and federal agencies stepped forward to make all systems work as efficiently and effectively as possible. Red tape was cut and new commuter rail routes and facilities were opened in days instead of years. Elsewhere, tragic and bizarre events, in which passengers were injured or killed, have occurred on several systems. Even though these incidents are rare, they do influence rider perception of personal security and often result in riders electing not to use transit.

Proposed federal legislation includes a 22 percent increase in capital funding for transit.

Marine Transportation

Within the marine and intermodal communities, there were high hopes that the passage of ISTEA would bring much-needed support for improved port access and development of intermodal facilities. Progress in finding a significant level of support for revitalizing the freight infrastructure under ISTEA has not lived up to all these hopes. This suggests that the port community will have to continue its public education campaign and press for funding attention on all levels. The expanded role for MPOs in developing the local Transportation Improvement Programs necessitates that ports and other freight interests must now work closely with these organizations and state DOTs to better inform the planners and general public about the economic impli-

cations of efficient goods movement. Several DOTs and MPOs have made significant progress in the development of freight advisory councils to improve their understanding of goods movement and in soliciting input for the development of intermodal management systems.

Channel deepening, harbor maintenance, and dredged material disposal remain as major challenges for the nation's deep water ports. Channels must be continually dredged to allow safe passage of deep draft vessels. Ports must grapple with a grueling dredge approval process in order to accommodate environmentally acceptable disposal plans; ports face escalating costs for feasibility studies, disposal projects, and mitigation efforts. There are continual efforts to impose higher user fees for channel improvements that in turn significantly affect the competitive position of ports. The complexities involved in satisfying all elements of the dredge approval process have been categorized as institutional "gridlock."

For the past year, port interests have been lobbying Congress to enact a national dredging policy. Concurrent efforts are being led by the Maritime Administration in its work with a federal interagency coordinating group to ensure that the myriad of agencies involved in the permitting process facilitates rather than stalls the process.

A 1994 AAPA survey of U.S. seaports indicated that port facility development and capital requirements are their most urgent problems, followed closely by the environmental thicket that accompanies dredging and dredged material disposal.

Competition for public funds for infrastructure development is intense, and ports are facing potential diversions of port funds to nonmaritime activities. Ports are also being challenged by shifting trade logistics that require capital intensive intermodal innovations in shoreside infrastructure. Ports need to simultaneously invest in channel maintenance for waterside access and to provide shoreside systems to accommodate vessels of increasing sizes (4000 TEUs). To move cargoes inland, "on or near dock" intermodal transfer facilities must be planned and financed. In 1992 the industry invested $671 million in capital projects, and the projection for 1993–1997 capital projects represents a total of $5.5 billion.


PORT OF TACOMA

A recent analysis by American Association of Port Authorities of strategic issues for U.S. seaports indicated that port facility development and capital requirements present the most urgent problems.

Maritime reform remains a top priority for the U.S. DOT leadership. The U.S. DOT and its Maritime Administration are promoting a maritime security and trade act of 1994. This $1 billion, 10-year program intends to support the rapidly diminishing U.S. flag fleet through a tonnage fees tax.

Continuing to provide a cost-effective inland waterway system is of critical importance, but funding the necessary infrastructure is under debate. River traffic is expanding and lock capacity and maintenance are seriously stressed, and the aftermath of the devastating flood of 1993 presents a host of new challenges. The U.S. Army Corps of Engineers (USACE) is operating an ongoing rehabilitation program to maintain present lock and dam efficiency and is assessing enhanced system improvements in a System Navigation Study.

USACE seeks guidance from the Inland Waterways User Board to rank inland waterway modernization projects in order of priority. There are serious concerns that the Inland Waterways Trust Fund could be depleted by an aggressive construction schedule and thereby renew the pressure for increased waterway fuel and user taxes. In the current operating environment of higher costs and depressed freight rates, operators are additionally challenged by a host of new safety requirements being proposed for barge and tow operators. A number of regulations regarding vessel inspections and certification, vessel equipment, and operator training are under consideration by the Coast Guard in response to recent waterway accidents.

ISTEA funds have allowed for enhancement of certain ferry routes that alleviate roadway congestion, offering alternatives for both the commuter and tourist. Passenger ferry services fill a unique transportation niche, but in order to ensure adequate ridership, local sponsors must address (*a*) the challenge of efficient intermodal connections to terminals, (*b*) workable fare structures and schedules, and (*c*) safe vessel operations. Enhanced ferry operations are under development in Alaska, the Puget Sound, San Francisco, Puerto Rico, New York, and Boston.

Large and small ferry operators alike seek consistency of regulations. Currently, operators face complex and costly Americans with Disabilities Act regulations with little guidance about practical implementation.

Aviation

The U.S. airline industry is now entering a fifth consecutive year of financial losses, sluggish traffic growth, and structural realignment. Combined losses by U.S. major carriers since 1989 now total more than $9 billion. Although traffic has rebounded in response to the steady, albeit slow, economic recovery of the past 18 months, enplanements have not yet returned to the level of 1990–1991. Airline yields (average price paid per passenger mile) were up only slightly from 1992, due largely to an ill-advised round of competitive fare cuts by major carriers in the summer of 1993. At the close of 1993 almost half of the major airlines remained in financial difficulty, and those that were profitable showed only modest revenue gains.

There have been bright spots. The continued success of Southwest Airlines demonstrates that a carrier offering no-frills and point-to-point service to selected markets can survive and prosper. This has encouraged other niche-seeking entrants. Regional carriers have recorded robust traffic growth and increased profits by picking up short-haul routes formerly served by their code-sharing major airline partners.

At all levels—nationally, regionally, and globally—the air transport industry continues to follow a path to increased concentration and higher economic efficiency. Mergers and marketing alliances are being formed, route structures combined and rationalized, operating costs cut, labor forces sharply reduced, and capital expenditures closely scrutinized. Industry analysts foresee that over the long term (by the first few years of the next century), a much more concentrated, operationally lean and efficient air transport system will evolve. This system will consist primarily of a dozen or so global carriers supported by regional feeders that operate on a continental scale with connecting links to other parts of the world.

The emergence of this handful of worldwide megacarriers will have profound effects on aircraft manufacturers and airport operators. For the makers of aircraft it will mean demand for an increased number of long-range aircraft for intercontinental operations and an accompanying rise in short-haul turboprop or jet aircraft to serve hub-and-spoke routes radiating from major international airports. Airport operators will find themselves under pressure to expand their facilities to accommodate global-scale aviation activities at lower operating cost and with more flexible arrangements to adapt to shifting patterns of demand. Expanding airport capacity is taking place at some existing airports, and the most significant accomplishment will be the opening of the new Denver airport.

Air traffic control systems will have to be upgraded to handle greater demand, provide improved services, and be more uniform worldwide.

Air traffic control (ATC) systems will have to be upgraded to handle greater demand, to provide improved services, and to be more uniform worldwide. FAA's major effort to upgrade its ATC system has experienced serious cost overruns and time delays. Current attempts to put the project back on course are complicated by proposals to transfer the ATC function to a new private or quasi-government organization.

Other sectors of civil aviation—business aviation, helicopters, and light general aviation (small, piston-engine fixed-wing aircraft)—are still in the doldrums. The recession and subsequent slow recovery have caused many businesses to reduce or eliminate their corporate fleets in the interest of cutting overhead costs and to substitute time-sharing arrangements, new forms of charter service, and other innovative air transport arrangements. Helicopter sales remain depressed. Although helicopter operators have managed to find market niches where they can survive, they continue to be plagued by high costs and operating restrictions. Light general aviation is still shrinking in fleet size, flight hours, shipment of new aircraft, pilot population, number of aviation maintenance technicians, and fixed-base operations. The outlook for these three segments of civil aviation is for continued decline through the remainder of this century. Only the most optimistic observers expect that any of these segments will be able to hold their own.

Rail

In 1993 the railroads carried record volumes of both total freight and intermodal traffic reflecting the nation's economic growth. This record was attained despite adverse operating conditions caused by the midwestern floods. In turn, this growth has been reflected in several dramatic ways: the purchase of new cars rose to a level not seen in more than a decade and the purchase of locomotives also showed a striking increase. Orders for new equipment indicate that the trend will continue this year. Improved market share for rail, particularly in automotive and intermodal traffic, and upgrading of fleets to better

Improved operating efficiencies are expected when new 5,000 horsepower locomotives go into freight service in the near future. This is the highest horsepower locomotive currently manufactured in the United States.

meet customer needs are factors also contributing to increased equipment purchases. Similarly, there are indications of capacity constraints in portions of the railroad freight network, a dramatic turnaround after two decades of downsizing by all the major carriers.

Included in the new equipment orders, four of the Class 1 railroads have ordered high technology alternating current (AC) locomotives. These diesel-powered locomotives use AC motors (instead of the traditional direct current motors) and promise operating efficiencies through greater traction power and lower maintenance costs.

Improving the quality of service to meet customer needs is now the driving force in the rail freight industry. The railroad industry is also benefitting from investments in automatic equipment identification, electronic data interchange systems, and improved car management systems.

Amtrak continues efforts to improve trip times on the Northeast Corridor (NEC) through both electrification of the New Haven-to-Boston portion of the route and acquisition of higher-speed equipment. Based on test results of the Swedish X2000 and the German ICE trains, Amtrak has begun a procedure to procure 26 new higher-speed train sets for use on the NEC. Five competing consortia of manufacturers have entered the process to develop equipment best suited for NEC operations. Elsewhere on the Amtrak system, however, some contractions in service have been necessary because of inadequate funding.

A number of states continue to explore the potential application of high-speed rail technology, but insufficient funds are still delaying implementation of these projects.

Continued federal funding for the Local Rail Freight Assistance Program is once again in doubt. Many states continue to reap economic benefits from investments in continuing rail freight services on branch lines that could not be sustained by Class 1 railroads. A number of states are using loan programs to maximize the use of existing funds. Nearly half of the states have invested their own funds on rail freight preservation projects in recent years.