TRENDS

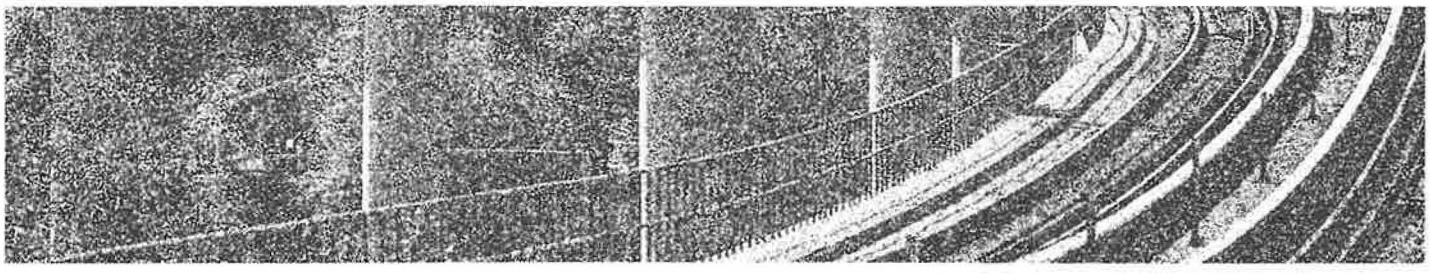
IN TRANSPORTATION

TRB's Field Visit Program in 1992–1993

Each year TRB staff members visit all of the state highway and transportation departments, 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 and 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.

These annual visits provide the opportunity to collect and share transportation research information. Although other forms of information transfer such as publications and automated services are available, the visit program offers the unique advantage of one-on-one discussions to fully explore areas of mutual interest. Personal visits can also identify innovative or experimental work that will not be published for wide dissemination, but nevertheless is worth bringing to the attention of others.

Another benefit from the program is the opportunity to describe TRB's range of services to new people in the transportation agencies that support the Board. The visits also serve to identify potential candidates for TRB standing committees, National Cooperative Highway Research Program and Transit Cooperative Research Program panels, and special project committees.



PORTLOCK/WMATA

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and the Clean Air Act Amendments of 1990 (CAAA) continued to be the predominant discussion topics of transportation officials at the national, state, and local levels in 1992–1993. Uncertainty over ISTEA funding levels, implications of greater flexibility in the use of funds, a host of new planning requirements and management systems, transferred responsibilities, and new environmental considerations provided a challenge—not only for carrying out the various provisions of ISTEA and CAAA, but also for trying to understand their intent. Attempting to define what constitutes "intermodalism" also received much attention this year.

The presence of a new administration was felt throughout the transportation field. Proposals for energy taxes and the potential impact of the economic stimulus package on infrastructure investment attracted considerable interest. Other high-priority areas for the new administration included intermodalism and maritime policy.

Intelligent Vehicle Highway Systems (IVHS) assumed a place of prominence in the transportation mainstream. IVHS America continued into its third year with steadily expanding programs and constituency. ISTEA provided $660 million for IVHS research and development over a six-year period, making the United States a major player in this area. IVHS projects are under way in several states, with many others planned.

DELANEY/ENVIRONMENTAL PROTECTION AGENCY

Transportation of hazardous materials received considerable attention during the past year.

As IVHS advanced, the Strategic Highway Research Program (SHRP) prepared to exit the scene. SHRP's five-year life is concluding with the Federal Highway Administration (FHWA), the Transportation Research Board, and the states, along with the American Association of State Highway and Transportation Officials (AASHTO), assuming the follow-up activities. These include long-term pavement performance (LTPP) data collection and monitoring and SHRP product implementation. The states' commitment to collect the LTPP performance data extends for another 15 years.

Other areas receiving considerable attention during the past year included total quality management, innovative contracting practices, handling and shipment of hazardous materials, recycling materials, increasing use of light rail transit and ferry systems, and the competitive position of U.S. industry (with the economic stability of airlines of particular concern).

These topics and many others were discussed with hundreds of transportation professionals as TRB staff visited state agencies, universities, and industry groups during the past year. The following is a summary of transportation issues, trends, and research activities identified during these visits and through other staff efforts.

Planning

ISTEA provides states and regions with substantial new flexibility in project eligibility to meet transportation, environmental, and social needs. Along with this new flexibility comes a rigorous set of planning requirements to ensure adequate consideration of the numerous factors affecting transportation decisions.

As a result, ISTEA continues to dominate transportation planning at state and local/regional levels. More questions may have been raised than answered about the new planning requirements. Uncertainty about definitions of what constitutes "multimodal transportation planning," "intermodalism," and "management systems" is hindering the implementation of the requirements of the act. Further clarification and interpretation of such terminology are needed before realistic assessments can be made of the ability to incorporate the various provisions into the planning process.

Reinforcing some of these concerns is a survey conducted by AASHTO, in cooperation with the National Association of Regional Councils and the American Public Transit Association, to examine the relationships among state departments of transportation, metropolitan planning organizations (MPOs), and transit agencies and how they are affected by ISTEA. The survey pointed out some of the major challenges and opportunities resulting from the ISTEA requirements, including (a) coordination and cooperation between DOTs and MPOs; (b) reporting requirements; (c) determining equitable methods for distribution of funds; (d) developing management systems and plans under tight deadlines; (e) mandated use of funds for safety and enhancement programs; (f) integrating land use, clean air requirements, and transportation planning; and (g) partnerships with nontransportation interests and local governments.

Participants in the TRB Conference on Transportation Data Needs: Implications for State DOTs and MPOs, concluded that the requirements of ISTEA and CAAA call for a rethinking of the traditional approaches to planning and the required supporting data. The accuracy of the traditional models and forecasting procedures may no longer be adequate, and the models may not provide the needed feedback between land use and travel demand forecasts. Additional data are required to support the new emphasis on intermodal planning and the development and maintenance of management systems related to highway pavement, bridges, safety, congestion, public transportation facilities and equipment, and intermodal facilities and systems.

Without question, the most difficult area facing states is CAAA, requiring states to integrate and coordinate their air quality and transportation planning processes. The act also sets a firm schedule for states to reach attainment of air quality stan-

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Congestion pricing is one of alternative financing techniques being considered for urban transportation.

dards. Perhaps the most important and far-reaching provision of CAAA is the requirement that state transportation plans must conform to state air quality plans. Various environmental groups have initiated litigation in one northeastern state claiming that a project is in violation of the CAAA conformity requirements. Three other northeastern states have received notices of intent-to-sue notices.

Finance

With the search for means to reduce the federal deficit, as well as to encourage energy conservation, energy taxes are being considered. These may be carbon taxes, which would also reduce carbon dioxide emissions, a BTU tax, or a sales tax.

If such taxes are added to motor fuels, further federal and state fuel tax increases may be preempted. As a result, there is considerable interest in alternative financing techniques for transportation. These include congestion pricing, green fees (environmental impact fees), and tolls. Congestion pricing—paying a variable toll for use of congested highways at peak demand periods—is receiving renewed attention. Technologies are available that will automatically identify and bill individual vehicles using congested facilities. The main impediments to such road pricing are consideration of equity and the economic impact on the local area.

Greater use of alternative fuels will require a reevaluation of current fuel tax exemptions (both federal and state) for alcohol/gasoline blends that make up 20 percent of the market. These exemptions reduce trust fund receipts by more than $500 million per year.

Avoidance of payment of gasoline and diesel fuel taxes continues to result in lost revenue. The estimated loss to federal and state governments may be as high as $2.5 billion per year.

Human Resources

State programs of early retirement incentives continued this past year and induced more people to retire than was anticipated. Some states lost as much as 10 percent of their work force. Although most states are attempting to hire new engineers-in-training at the entry level, the total number of state transportation department employees continues to decline as it has for the past decade and retired employees are not being replaced. There is an ever-increasing reliance on the use of contract services for construction planning and engineering, traffic operations, and maintenance. Also, some states have started using contractors for project inspection functions.

Many states have aggressively increased their management training programs because of the rapid turnover of top-level management personnel. Recognizing that the makeup of the incoming work force may be substantially different, these management programs include diversity and total quality management training.

Environment

Conformance with CAAA standards is the key issue in the environmental area. Under ISTEA and CAAA, the burden of proof for adverse environmental impacts has changed. As part of the required State Implementation Plan, it is no longer sufficient to show that proposed projects do not have an adverse effect on air quality. Instead, the burden of proof is on the states and MPOs to show that their plans have a positive benefit on air quality.

Environmental groups have brought legal challenges to states' conformity implementation plans. The long-term consequences of such actions are unsure. If Congress remains steadfast to the current legislation, conformity may have a substantial effect on the future development patterns of urban areas. Conformity may preclude increasing development density in urban areas and encourage further urban sprawl to the exurbs or relocation of the population to smaller cities where air quality attainment is not an issue. Certainly, individual driving behavior has been contrary to that espoused in traffic control plans. Between 1980 and 1990 the

WISE

Introduction of alternative fuels and alternative fuel vehicles, such as electric car shown, is required under Alternative Motor Fuels Act of 1988.

number of drivers carpooling declined more than 6 percent (to 13.4 percent of total work trips). Transit trips during that period remained the same in absolute numbers, even though the percentage declined 1 percent (to 5.3 percent). The Environmental Protection Agency's announcement on conformity, in contrast, stated that it "will ensure that expansion of roads and other transportation facilities will not lead to increases in motor vehicle travel."

The introduction of alternative fuels and alternative fuel vehicles is required under the Alternative Motor Fuels Act of 1988. Governmental and large corporate fleet vehicles are targets for the introduction of alternative fuel vehicles that will use natural gas, electric battery, ethanol, methanol, and propane, as well as reformulated gasoline and diesel fuels. The law requires that 30 percent of new automobiles and light-duty trucks that are centrally fueled fleet vehicles use alternative fuels by 1998, 50 percent by 1999, and 70 percent by 2000. Reformulated fuels are being used in the 39 most-polluted metropolitan areas in the winter months to reduce the air pollution caused by cold starts and stagnant air. There are many who believe that alternative fuel vehicles are the only solution to urban pollution problems and that traffic systems management and control measures will have only minimal effect on urban air quality.

Water quality, wetlands taking and replacement, and on-site hazardous materials continue to be major impediments to the development of new highways on new rights-of-way. These and other environmental concerns have resulted in an increased focus by state departments of transportation (DOTs) toward improving the traffic flow of existing facilities rather than adding new facilities. There is a strong belief among the states that the current environmental review processes are (a) too arbitrary and inflexible, (b) have too many review and concurrence points, and (c) do not really reflect the comparative risks and costs.

Design

Almost all states now have an operational pavement management system (PMS) in place. The current challenge is to complete the data input so that the system can be integrated into the decision-making process. The SHRP LTPP data base will provide information on pavement life, improved pavement design, and rehabilitation that can be incorporated into these systems. ASTM has been working on standards for all aspects of the PMS process, and researchers have been greatly expanding the knowledge base of the PMS and related technologies. Some areas of research that continue to be studied are rapid, automated, nondestructive pavement testing; mechanistic/empirical pavement design; and data collection, handling, and analysis techniques. Future challenges include incorporation of new equipment, techniques, and philosophies into PMS. TRB will conduct a major conference (3rd International Conference on Managing Pavements) in May 1994 in San Antonio, Texas, to exchange information on advances in the pavement management field.


DAUPHIN AND PELRY CO.

TRB's National Cooperative Highway Research Program has completed Project 12-33, Development of a Comprehensive Bridge Specification and Commentary.

With the completion of National Cooperative Highway Research Program (NCHRP) Project 12-33, Development of a Comprehensive Bridge Specification and Commentary, AASHTO is in the early stages of making decisions on its adoption. The Highway Subcommittee on Bridges and Structures is taking the lead in considering these new bridge design specifications, which are based on the Load and Resistance Factor Design approach. Another aspect of bridges that is receiving considerable attention is susceptibility to scour. A research effort is 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 when there is little or no available information.

Many new and different concepts have been developed by SHRP, and states are meeting the challenge to evaluate and implement SHRP products. New approaches often require skills and equipment not presently available and may require the states to use outside agencies. States continue to be concerned about the resources needed to complete SHRP's LTPP project.

An area of high interest to state DOTs is that of roadside safety features. *NCHRP Report 350: Recommended Procedures for the Safety Performance Evaluation of Highway Features* has been issued, replacing *NCHRP Report 230*, which for many years was the primary reference on crash testing. Attention has been given to the need for international harmonization of testing and evaluation procedures for roadside safety features through the publication of *TRB Circular 396* and through special sessions and committee meetings at the TRB annual meeting.

Metrication is another major issue for the state DOTs. FHWA has developed its plan to comply with the Omnibus Trade and Competitiveness Act of 1988, and the plan will lead to the use of metric (SI) units in direct federal and federal-aid construction contracts by September 30, 1996. AASHTO has a Task Force on Metrication

under its Standing Committee on Highways that is working with other groups to bring about a smooth transition to metric. *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. TRB is now introducing metric units in its publications.

Materials and Construction

The majority of state agencies are at least experimenting with recycling and the use of waste materials and byproducts in highway construction. Most now specify or allow the use of reclaimed asphalt pavement in new or recycled asphalt concrete mixes and many specify coal fly ash as a cement replacement in portland cement concrete mixes. Other waste materials, especially scrap rubber tires, are being investigated for engineering use as the environmental consciousness of the nation continues to increase.

ISTEA focused transportation agencies on the use of scrap rubber tires as a crumb rubber modifier (CRM) in asphalt paving materials. The act is accelerating research activity at the state and national level as transportation agencies attempt to mitigate their concerns about the performance and recyclability of asphalt pavements constructed with CRM.

Many state agencies are still struggling with plastic deformation problems in asphalt pavements. Research continues on the use of large-stone mixtures and stone mastic asphalt in mitigating rutting.

State agencies continue to experiment with innovations in contracting practices: design/build, cost-plus-time bidding, lane rental, and the use of warranties. A number of these agencies have successfully used the cost-plus-time concept on critical construction projects. The use of warranties has been applied to such activities as bridge painting, pavement markings, concrete pavement patching, and asphalt overlays.

Several state transportation agencies are evaluating public and private "partnering" on construction projects. The management concept has the support of the private construction industry. Both owners and contractors appear to be tired of the claims, litigation, and confrontations that have become too common on construction projects and are hopeful that this concept of working together as stakeholders will resolve the problem.

Quality in construction has a renewed national emphasis. State agencies through AASHTO are participating in the National Quality Initiative program. A few states are adopting total quality management procedures, and quality control/assurance is appearing in more state specification books as agencies strive to meet increasing workloads with fewer employees.

Soils, Geology, and Foundations

State agencies have tried several approaches over the years to mitigate pavement damage caused by moisture. Approximately two-thirds of the states are currently using permeable bases and edge drains. Information is needed on proper testing, installation, and performance monitoring methods, as well as on screening procedures for selecting site-specific drainage systems. To address these concerns, NCHRP is conducting a project on long-term performance of geosynthetics in drainage applications, a synthesis study on pavement subsurface drainage systems is being initiated, and TRB Annual Meeting sessions focus on this topic.

When hazardous materials are encountered on project sites or rights-of-way, proper procedures are needed to guide the investigation, testing, and mitigation. Dissemination of information on remediation procedures such as bioremediation, slurry walls, in situ soil mixing and capping, vacuum extractions, jet grouting, and electro-osmosis is needed.

Slope failures and rock falls along highways are a major concern for states. A TRB Special Report: Landslides—Investigation and Mitigation, is expected to be available in 1994.

Both metallic and geosynthetic reinforcements have been used to address slope stability problems. Durability of these reinforcements has emerged as a concern and improved procedures for identification, measurement, monitoring, and mitigation of the problem are needed by state engineers.

Ground vibration generated by impact or vibratory hammers, or other means used for driving piles, has raised concern about the potential effects on buildings, subsurface utilities, and adjacent transportation structures. An upcoming NCHRP synthesis project will focus on this issue.

Maintenance

Maintenance of an aging roadway system with fewer employees is contributing to the increased use of private contractors. Contractors are used primarily for work that can be easily defined and inspected, including guardrail repair, bridge painting, joint sealing, bridge deck repair, roadside

CMI CORPORATION

Concrete material transfer/placer. Quality in construction is receiving renewed national emphasis.

vegetation control, and storm drainage pipe replacement and repair. Contracting of maintenance activities currently takes place in several European countries where legislation requires privatization of maintenance work. In England, maintenance forces are being assembled under direct labor organizations that must compete with the private sector for maintenance contracts.

Mechanization methods developed under SHRP for pothole patching and joint sealing are being evaluated by several states. These methods are viewed as potential solutions to traffic flow and safety problems associated with these maintenance activities in urban areas. Removal, containment, and disposal of lead-based paints on bridges continue to be high cost items for transportation agencies. Several states are conducting research efforts to develop environmentally benign coatings, as well as coatings to encapsulate deteriorated surfaces. The construction of salt storage facilities to cover stock piles and the use of containment systems to capture brine runoff are now considered standard practice in the snow belt states.

Snow removal and ice control technologies in the form of new plow designs, weather forecasting systems, and pre-storm anti-icing technologies are being applied in highway maintenance strategies. New plow designs offer improved snow handling capabilities, reduced truck power requirements, and improved truck steering for high-speed operations. Road-weather systems are being used to identify when and what type of winter maintenance actions are needed. The objective of anti-icing is to reduce the amount of chemicals being applied while providing an adequate level of safety for the motoring public. Pre-storm anti-icing chemicals and techniques are showing promise of reducing chemical requirements by preventing the ice-roadway surface bond.

The safety of workers and the motoring public continues to be a high priority for transportation agencies. The use of truck-mounted attenuators (TMAs) on high-speed roadways is increasing. New crash test procedures have been proposed for TMAs and traffic control devices used in work zones. These new procedures would require a 100 percent increase in the energy-absorbing capabilities of TMA over current test procedures.

Standardized equipment specifications are being explored by several states to reduce purchase costs. As manufacturers install more high-tech devices on highway maintenance equipment, the educational requirements for shop mechanics are increasing.

Traffic Operations

Traffic congestion, air quality, development of IVHS, and the new challenges and opportunities offered by ISTEA are significantly affecting current and future provision of transportation services.

ISTEA established an IVHS program of approximately $660 million over the six-year authorization period. Thus the major research focus in traffic operations for the next decade and beyond will be on these "smart" cars and highways. IVHS includes a range of technologies that can improve mobility, enhance safety, and maximize the use of existing transportation facilities. IVHS technologies include advanced traffic management systems, advanced traveler information systems, advanced vehicle control systems, advanced rural transportation systems, advanced public transportation systems, and commercial vehicle operations.

Although the state-of-the-art in urban traffic signal control systems is not at the level envisioned in the IVHS scenarios, major gains could be made now in the traffic-carrying capabilities of streets through the use of available traffic control hardware and software. However, public agency budgets and staffing are generally not adequate to design, install, and maintain all the elements of the traffic control systems. Additionally, some states indicate that they lack sufficient technical expertise to effectively manage the existing systems—let alone cope with the demands for greater manpower and technical skills that will be required with the IVHS technologies.

During the past several years, the need for managing traffic in freeway corridors, rather than just on the freeway itself, has been increasingly recognized. The INFORM project on Long Island is an example of the benefits that can be obtained from such an integrated approach to traffic management. Other examples include the FAME project in Seattle, the TIME project in Phoenix, and the "Smart" corridor in Los Angeles. Corridor projects control traffic on an integrated system basis using real-time data and will eventually include features such as coordinated operation of ramp metering and signal control, in-vehicle route guidance, and artificial intelligence and expert systems. In these integrated systems, traffic information is shared among several operating agencies and the traffic control decisions are made jointly. Many states are now considering the implementation of such systems, for which the capital and

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Traffic control hardware and software could increase traffic-carrying capabilities of highways, but public agency budgets, staffing, and expertise often fall short of this goal.

operating costs for traffic monitoring, management, and control are eligible for funding under ISTEA.

Nonrecurring congestion caused by accidents, disabled vehicles, and spilled loads is believed to account for more than 50 percent of the delay on the nation's urban freeway system. Recognizing this, techniques for freeway incident management are receiving considerable interest in many states and urban areas. Incident management programs minimize the impact of a freeway incident by reducing its duration and managing traffic efficiently while it is occurring. Many areas of the country already have comprehensive incident management programs in place and others are in the process of developing them. Studies of these existing programs clearly demonstrate that they are cost-effective in reducing traffic congestion.

The graying of America is also of concern to traffic operations personnel. For instance, some states are evaluating the use of larger lettering on traffic signs and higher levels of retroreflection to improve the conspicuity and readability of the devices. One state has implemented an older driver program that includes short-term operational improvements such as larger lettering on overhead and street name signs; wider pavement markings; closer spacing of raised pavement markers; improvements in signs, markings, and pedestrian crossing times at signalized pedestrian crossings; and more work-zone safety improvements.

Safety

The fatal accident rate continues to decline—down from a death rate of 1.9 per 100 million vehicle miles driven in 1991 to 1.8 in 1992. Although the death rate is moving in the desired direction, efforts to reduce the number and severity of crashes (not just the death rate) must continue. The U.S. Department of Transportation has established goals in support of this objective; for example, 75 percent seat belt use and reduction of alcohol-involved fatalities on the highways to 43 percent of total fatalities by 1997.

The National Highway Traffic Safety Administration reported that seat belts saved 4,682 lives and prevented around 122,000 moderate to critical injuries in 1991. In December 1992 national seat belt usage was estimated to be 62 percent. The use of seat belts with air bags is further reducing driver deaths. The Insurance Institute for Highway Safety reported driver deaths were reduced by 29 percent in frontal crashes of air bag-equipped cars, compared with those with seat/shoulder belts only.

Alcohol-related deaths dropped to 48 percent of the reported fatalities in 1991.

As complex legislative requirements are translated into rules, programs, and projects, transit agencies are participating in the rule-making process to ensure workability.

Among 15 to 20-year-old drivers the percentage has steadily decreased for a decade and for 1991 was at 20 percent. Enforcement of youth laws, such as Maryland's 0.02 blood alcohol content (BAC) for under 21-year-old drivers, combined with strong public information and education campaigns, have been shown effective in reducing alcohol-related young driver deaths. Among all drivers killed in accidents in which alcohol was involved, 79 percent had very high BAC levels (more than than 0.15).

There has been considerable discussion of the problem of uninsured motorists. The Research and Development Section of the California Department of Motor Vehicles determined that the cost caused by accidents of uninsured motorists was $2.37 billion, or $159 per insured motorist (based on 1989 data).

To more precisely identify accident causes and develop targeted countermeasures, the Insurance Institute for Highway Safety studied crashes in four urban areas. Five crash types accounted for 76 percent of all crashes and 83 percent of injury crashes. In rank order the crash types were disregarding traffic control devices, stopped or stopping, ran off road, lane change, and left turns.

Transit, Aviation, Rail, and Water

Transit

Transit continues to experience both challenge and opportunity. Recent federal legislation, new local services and activities, and a new research program hold significant promise for states, their local transit systems, and the nation.

Implementation of major federal transportation legislation [ISTEA, Americans with Disabilities Act (ADA), and CAAA] remains a high priority. As complex legislative requirements are translated into rules, programs, and projects, transit agencies are participating in the rule-making process to ensure workability.

One component of ISTEA, employer transit subsidy to a maximum of $60 per month per employee, is receiving considerable attention. For example, the Washington Area Metropolitan Transit Authority has developed a comprehensive "Metrochek" program.

The new administration supports ISTEA, ADA, and Clean Air legislative public policy goals and has announced its intent to fund them to the maximum extent possible. However, there is uncertainty amid growing fiscal pressures. Related proposals to reduce the deficit include an "energy tax," which may have serious impacts on transit costs, service, and ridership. Given the fiscal fluidity, many state and local agencies find financial planning and projections to be quite complex and variable.

A wide range of change and innovation is occurring as long-term transit plans are becoming realities. In Southern California, a commuter rail network started operation in three corridors (114 miles). The first leg (4.4 miles) of Metrorail opened at the same time as a renovated Union Station (subway, bus, shuttles, commuter rail, and AMTRAK). Future plans call for development of a major commercial office/hotel/entertainment center above the newly completed intermodal facility. Other areas started (or are seriously considering starting) commuter rail service: Washington, D.C., to Northern Virginia; Atlanta; Cleve-

land; Dallas; Denver; Houston; Memphis; Phoenix; and Seattle. Interest in light rail transit is also evident. New light rail systems or extensions are planned to open in 1993 (Baltimore, St. Louis), 1994 (Denver, Los Angeles), and 1996 (Dallas). Transit operators and suppliers are exploring capital equipment needs for ADA and air quality. Low-floor buses for easier access by the elderly and handicapped are under serious consideration. Finally, agencies are investigating total quality management as a promising approach to improve internal administration and transit service.

Responding to state and local research needs, the TRB Transit Cooperative Research Program, funded by the Federal Transit Administration in cooperation with the American Public Transit Association, has initiated 16 projects and will start more than 20 other projects in 1993. The majority of research ideas are developed by state and local agencies.

On the whole, transit is meeting these challenges and opportunities, while facing financial constraints.

Aviation

The past three years have been disastrous for commercial aviation in the United States. The record net losses of $3.9 billion suffered by U.S. scheduled air carriers in 1990 were followed by further losses of $1.9 billion in 1991 and $2.2 billion in 1992. The airlines lost more in the last 3 years than they made in the previous 45.

The financial picture for airlines worldwide has been much the same. Recessions in Europe and Asia in 1990–1991 and lethargic recovery in 1992 have led to continuing and substantial losses for all but a few foreign carriers.

However, there are some recent encouraging signs, at least in the United States. Passenger enplanements are beginning to rise, although at a rate still below that of 1985–1990. There are also indications that industry profitability is improving, not only because of the economic upturn and the onset of the summer peak travel season, but also because of greater airline discipline in pricing strategies since the ill-advised fare war of 1992 and the application of severe cost-cutting measures—layoffs, contracting out maintenance and ground services, cutting back on operations at secondary hubs, grounding a portion of their fleets, and canceling or deferring orders for new aircraft.

The return to some semblance of profitability will probably be too late and too little for the financially weakest carriers. Eastern, Pan American, and four large or medium regional carriers have disappeared since 1991, and three major carriers (Continental, America West, and TWA) entered or remained in Chapter 11 bankruptcy during 1992. The expectation is that industry consolidation will continue and perhaps accelerate over the next two or three years as the stronger surviving airlines jockey for competitive advantage and seek to expand their route structures, especially their overseas connections.

Industry consolidation appears to be entering a new phase. Financially troubled U.S. airlines are now negotiating with foreign airlines to form alliances, effect mergers, or obtain financial assistance. The arrangements between Northwest and KLM, USAir and British Airways, and Continental and Air Canada are illustrative of this new pattern of consolidation and international partnership.

The globalization of the airline industry is not confined to the North American market, even though links with U.S. airlines are among those most actively sought by foreign carriers. Alliances and mergers are forming in Europe, Asia, South America, and some of the former Soviet Bloc countries. The long-term outlook is that the worldwide airline industry will coalesce into a dozen or so megacarriers (four or five based in North America, a like number in Europe, and two or three in Asia). All will operate on a global scale and seek to dominate the air travel market within their continent and provide extensive connecting service to other parts of the world.

Airport expansion and development, which has been quiescent for nearly two

CHAMPLIN/METROPOLITAN WASHINGTON AIRPORTS AUTHORITY

Expansion and development of U.S. airports is growing. Model of proposed new terminal at Washington, D.C.'s National Airport.

decades, is now on the upsurge. In addition to the new midfield terminal in Pittsburgh opened in October 1992 and the new Denver airport due to open in late 1993, major expansions or new facilities are planned or in progress in Atlanta, Chicago, Dallas-Fort Worth, Detroit, Los Angeles, Miami, New York, Orlando, Philadelphia, St. Louis, and Washington, D.C. Gigantic new airport complexes are being built in Hong Kong, Macao, Osaka-Kansai, Bangkok, Frankfurt, Amsterdam, and London's Heathrow. Airport planners and builders seem to be of the view that air travel is on the verge of enormous growth and that major new international hubs will be required to handle the expansion of traffic, particularly in the Pacific Rim.

ISTEA legislation opens possibilities for developments to link airports more effectively with surface transportation systems. However, implementation of ISTEA provisions is somewhat spotty and slow to get under way. Some states have begun efforts to develop intermodal transportation complexes that would provide seamless door-to-door travel, but most have not yet succeeded in setting up the institutional and intergovernmental arrangements envisioned by ISTEA, much less put in motion intermodal planning and projects.

Rail

The passage of ISTEA has brought both hope and frustration to public and private sector officials involved in railroad transportation. The emphasis on intermodal and multimodal planning by states and MPOs holds the promise for consideration of the rail mode in conjunction with, or as an alternative to, other modes in freight and passenger transportation. Both public transportation agencies and private carriers, however, are expressing frustration because of the limitations on funding resources that can be used for rail projects.

Implementation of the provisions of CAAA to control emissions and efforts to reduce highway congestion have spurred interest in new rail passenger services and routes—both intercity and commuter rail. A number of states also continue to explore the potential application of high-speed rail technology, most notably Texas, where financing is still being arranged for the construction and operation of a high-speed system linking several major cities. Under the provisions of ISTEA, the Federal Railroad Administration has designated five corridors to receive modest funding for grade crossing improvements to allow for incremental increases in passenger train speeds.

AMTRAK, in conjunction with a number of states, has extended routes and enhanced existing intercity services. The scheduled electrification of the Northeast Corridor (NEC) between New Haven and Boston will improve trip times, as will use of new equipment such as the Swedish X2000 tilt train, which has been successfully tested and enthusiastically received by the public. The high-speed German InterCity Express (ICE) train was also tested on the NEC and other corridors in summer 1993. Amtrak will contract for the design and construction of new trainsets in 1994.

Densely populated port areas suffering from acute congestion and poor air quality have planned intermodal hub projects to facilitate rail transfer activities as an offset to highway congestion.

Interest in the possible application of maglev technology in several corridors remains high, but funding for construction and operation of these systems is a major hurdle to implementation. The recently completed National Maglev Initiative research program identified some potential improvements to existing maglev technology that could warrant additional development efforts.

Many states continue to reap economic benefits from investments in continuing rail freight services, particularly on light-density lines that cannot be sustained by the Class 1 carriers. However, the demand for track rehabilitation funds continues to exceed available funding. States and shortline rail carriers stress the need for public funding from a predictable, permanent source. The federally funded Local Rail Freight Assistance program has been successful, but faces the appropriations process every year and does not meet states' funding requests. A number of states are using loan programs to maximize the use of existing funds. In addition, nearly half of the states have invested their own funds on rail freight preservation projects in recent years.

From the standpoint of the freight railroad industry, improving the quality of service is the driving force behind investing in new technology to improve operations. The railroad industry is benefitting from investments in automatic equipment identification, electronic data interchange systems, and improved car management systems. Development of advanced train control systems promises more efficient train operations, resulting in higher-quality service. The increase in intermodal freight transportation is encouraging the development and testing of innovative rail/intermodal equipment. In addition, densely populated port areas suffering from acute congestion and poor air quality have planned intermodal hub projects to facilitate rail transfer activities as an offset to highway congestion.

Marine and Intermodal Transportation

Within the marine community, there were high hopes that the passage of ISTEA would bring much-needed support for improved port access and development of intermodal facilities. The progress in finding significant levels of support for revitalizing the public freight infrastructure has been limited under ISTEA. This realization suggests that the port and intermodal 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 the general public about the economic implications of efficient goods movement. Several DOTs and MPOs have developed

TRB Representative Luisa Paiewonsky, Massachusetts Highway Department, and other highway and FHWA personnel inspect segment of Central Artery North Area project in Boston, which was dedicated in September 1993.

freight advisory councils to improve their understanding of goods movement and to solicit input into the development of intermodal management systems.

For the nation's deep water ports, dredging and harbor maintenance continue to present a major challenge. Channels must be continually dredged to permit safe passage and docking of deep draft vessels. Ports must grapple with a grueling dredge approval process that must accommodate environmentally acceptable disposal plans, escalating costs for feasibility studies and disposal alternatives, and mitigation offsets. Continual attempts to impose higher user fees for channel improvements in turn significantly affect the competitive position of ports. The complexities involved in satisfying all elements of the dredge project approval process have been categorized as institutional gridlock. Solutions are under consideration by the Secretary of Transportation, the American Association of Port Authorities, and the U.S. Army Corps of Engineers.

The status of port-generated revenues came into question this year when deficits in one state's budget prompted the legislature to allow municipalities to divert "excess" revenues from the ports. To date, this practice has been limited, but other ports fear that it may gain in acceptance and jeopardize revenues that could have financed vital port capital projects.

In addition to facing potential diversions of port funds to nonmaritime activities, ports are also 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 1990 the industry invested $668 million in these capital projects, and the projection for 1992–1997 totals $5.3 billion.

Factors such as gentrification of the waterfront, complex capital budgeting needs, enhanced public scrutiny, and rapid technical innovations have put port directors under intense public pressure. The political appointment process for most port executives has resulted in high turnover rates. A few universities and maritime academies have developed port management courses to support professional development in the industry.

1992 was *almost* the year for a massive maritime reform, but the measure failed when Congress could not craft an acceptable funding package. Maritime reform has been cited as one of the three top priorities for the new U.S. Department of Transportation leadership, and a blue-ribbon industry advisory panel representing liner, bulk, labor, and shipyard interests is working with Secretary Peña to shape a comprehensive reform proposal. The U.S. flag liner industry views 1993 as the pivotal year to determine the fate of a continued U.S. flag liner presence.

The galvanizing event of the year for the nation's barge companies was the proposal to increase the fuel tax to $1 per gallon, a five-fold increase. A tax increase of this magnitude sent a shock wave through the industry and would certainly result in increased freight costs for moving bulk commodities. The inland waterway community is reacting with an aggressive information campaign about the costs and benefits of the inland system.

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. The U.S. Army Corps of Engineers is operating an ongoing rehabilitation program to maintain present lock and dam efficiency and is assessing enhanced system improvements in a System Navigation Study. Because of the widespread economic implications of efficient waterway systems and intermodal connections to the waterways, public-private interest groups such as the Midwest Area Coalition and the Pacific Northwest Waterways Association have been formed to increase awareness and to rank in priority order crucial waterway infrastructure projects.

Large and small ferry operators alike seek realistic and consistent regulations. Currently, operators face complex and costly ADA regulations with little guidance on practical implementation.

ISTEA funds have allowed for enhancement of certain ferry routes that alleviate roadway congestion, offering alternatives for both the commuter and tourist. Ferry services fill a unique transportation niche, but to ensure adequate ridership, localities must plan and allow for efficient intermodal connections to terminals, workable fare structures and schedules, and safe vessel operations. Enhanced passenger ferry operations are under development in Alaska, Boston, New York, Puerto Rico, the Puget Sound, and San Francisco.