

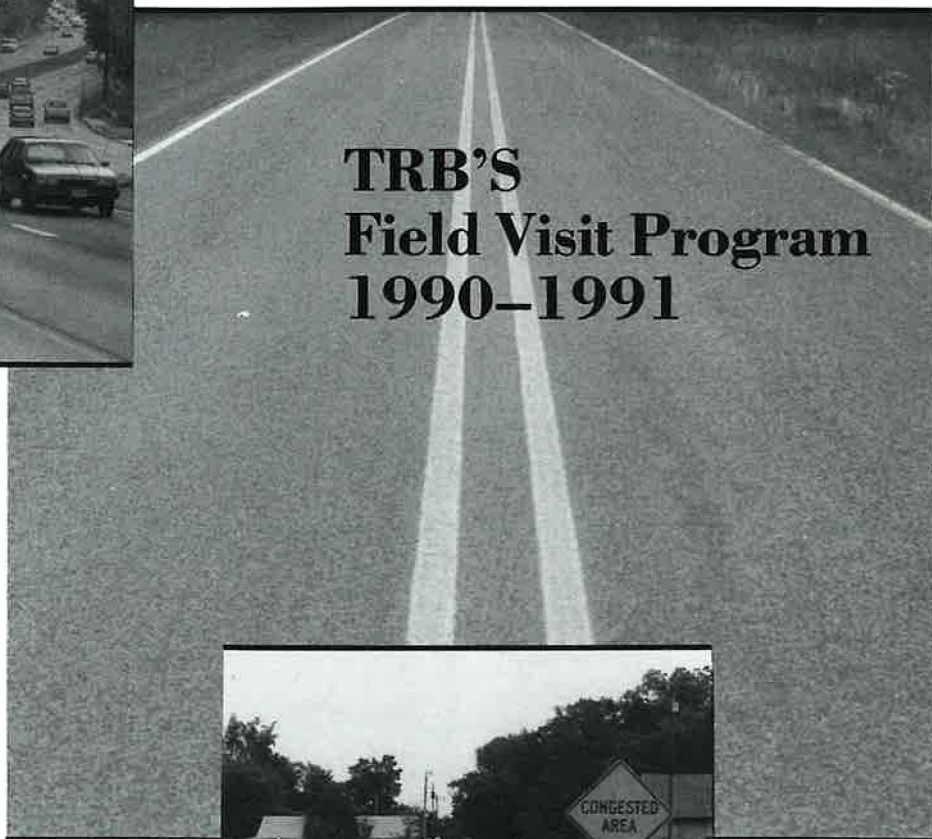
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## TRB'S Field Visit Program 1990-1991



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**E**ach year Transportation Research Board staff members visit every state highway and transportation department, many universities, transit and other modal agencies, and industry groups. The objectives of the field visit program are to (a) learn of problems facing the organization visited and to pass on information pertinent to the solution of these problems; (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. Other forms of information exchange such as publications and automated services are available, but the visit program offers the unique advantage of one-on-one discussions to explore areas of mutual interest.

Personal visits also identify innovative or experimental work that will not be published for wide dissemination, but nevertheless is worth bringing to the attention of others.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, Cooperative Research Program panels, and special project committees.

Proposals for new surface transportation legislation, including significant changes in funding levels and programs, were at the top of the agenda of those organizations visited this past year. Whereas strong support evolved from the Administration and Congress for greater investment in transportation, concerns surfaced about shifts in responsibility to the state and local levels and "winners and losers" among the states. In addition to infrastructure concerns, other specific areas of high interest included the role of the private sector, international outreach, environmental issues, and human resources.

The proposed expansion of the Federal Highway Administration's research program and a renewed emphasis on research in the Urban Mass Transportation Administration offered hope that transportation research would continue to gain momentum. Plans were developed for providing the FHWA program with input from the states and other sources. Intelligent vehicle-highway systems (IVHS), pavement management systems, and the Strategic Highway Research Program and plans for "after SHRP" were among the top research emphasis areas.

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

Increasing attention is being given to multimodal transportation issues and requirements by the states. Current planning activities are addressing intercity alternatives such as maglev and high-speed rail transportation, improved access to ports and harbors, and better linkages to airports. This emphasis on multimodal planning is expected to continue in light of the importance of transportation efficiency in maintaining U.S. competitiveness.

Two other factors are currently driving the planning process—environment and

congestion. Air quality, noise, wetlands, and hazardous materials are of increasing importance at both the state and metropolitan levels. Considerable attention is being given to land development issues, and new approaches are being formulated to mitigate the effects of traffic. Various congestion relief strategies are being developed to influence travel demand, such as flexible work hours, parking pricing, access management, rideshare promotion, and transit subsidies. Telecommuting, another congestion relief strategy, is increasing in importance in many parts of the country. It is estimated that there are 27 million (part- or full-time) telecommuters nationwide.

After years of research and development, geographic information systems (GIS) are being used more extensively by planning agencies to support analysis and decision making. Geographical data bases offer faster accessibility at lower cost and also make it easier to merge information from different data bases for analysis purposes. GIS also facilitates aggregating or disaggregating data for the analysis of different-sized areas and networks with different levels of detail.

## Finance

The recession has hit many state transportation agencies. In half the states, revenues have not met the forecasted growth rate and are below the inflation rate. As a result, states are facing budget cuts, primarily achieved through the elimination of vacant staff positions and through early retirement inducements. Although transportation funding in most states is protected through earmarking of revenues, budget and staffing

cuts have often been equally applied to all departments, including transportation, as part of across-the-board budget cuts.

The use of highway user funds for non-highway purposes is increasing. At the federal level, a new 5 cent per gallon gasoline tax was enacted for deficit reduction. Half of the new tax goes directly into the general fund. The other half goes into the Highway Trust Fund, but with the expenditure caps enacted with the deficit reduction legislation, it is questionable whether Congress will be able to increase the federal appropriation levels for highways, transit, or aviation beyond the inflation rate. Unencumbered balances in the federal trust funds are increasing and are being borrowed by the U.S. Department of the Treasury to offset the deficit.

In several states hundreds of millions of dollars are being transferred from state highway trust funds to the general fund. There is a growing question among legislatures as to whether highway user taxes should be dedicated solely for transportation purposes. Although highway interests

**1. Traffic congestion is causing traffic engineers to seek alternative solutions to add additional capacity within existing rights-of-way.**

**2. Increased distance between yellow lane lines is safety feature on Tennessee rural road.**

**3. Congestion can be a relative term.**

**4, 5. Wetlands and air quality are two major environmental issues facing transportation agencies.**



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are adamantly against using gasoline taxes for nonhighway purposes, advocates point out that gasoline accounts for only 5.4 cents out of a total cost of 33 cents per mile to operate an automobile in the United States, and that elsewhere in the world motor fuel taxes alone are often in the range of \$1 to \$2 per gallon.

As the states experience economic decline, the governors are turning to the transportation programs in an attempt to stimulate economic growth. Because transportation has a higher level of capital expenditure funds than other state programs, it is seen as offering a ready resource to help a state's economy. Research is under way to better define the specific relationships among transportation investments and economic development.

Air quality is a critical issue in many major urban areas. The use of oxygenated fuels will be mandated by the mid-1990s in urban areas currently experiencing high levels of pollution. About a dozen states and the federal government currently have a lower tax rate on motor fuels using 10 percent or more of alcohol. Unless there is a change in current tax laws, with the increase in use of oxygenated fuels there will be a proportionate reduction in fuel tax revenues.

## Human Resources

There has been a trend to move responsibility for human resources from the federal government to the state and local governments, placing greater staffing needs on these agencies. At the same time, budget cuts in many departments of transportation have resulted in the loss of the right to fill vacant positions: Governors and legislatures have provided inducements for long-term employees to take early retirement as a means of balancing the budget, even though the number of retirements occurring as a result of the normal maturing of the work force has peaked in recent years. Employees are often offered five extra years' credit toward retirement if they retire early. The number of years of required service has dropped to 25 years, and the minimum age to 50. As a result, many states are faced

with a loss of 25 percent of their staff (more than 50 percent of their senior employees), and are not being allowed to hire new replacements.

The departments are expanding their use of contract services for operations and maintenance, as well as the more common design and construction activities. A number of states are also undergoing an organizational analysis to determine whether the traditional structure and staffing of the agency should be changed to increase productivity.

## Environment

The two major environmental issues facing transportation agencies are wetlands and air quality in nonattainment urbanized areas. President Bush has maintained his goal of no net loss of wetlands with the result that wetland replacement is a major consideration in the construction or improvement of many highways. State transportation departments are still struggling with the review and approval agencies in defining and agreeing on terms of quantity and quality of wetland replacement and on what constitutes critical wetlands. Equating the new, lower-quality wetlands to those that will be lost continues to be a major issue in a process that is too often confrontational rather than cooperative.

Although the pollution emitted by automobiles has been reduced by 96 percent for hydrocarbons and 76 percent for nitrogen oxides during the last decade, the number of miles of travel in urban areas has more than doubled in the same period. In addition, the length of time that drivers retain their automobiles has increased, slowing the transition to the more fuel-efficient newer vehicles. Despite efforts to improve urban air quality, many major urban areas do not meet air quality standards.

To address this continuing problem, compounded by even more stringent air quality standards enacted by Congress, states and cities are developing new strategies. Oxygenated fuels, transportation demand reduction strategies, and higher motor vehicle fuel performance standards



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are considered to be the most promising approaches to improving air quality.

## Design

Transverse cracking in newly constructed bridge decks is a common problem. Cracking can cause deterioration of the bridge deck through the action of water and deicing chemicals and eventually lead to increased maintenance costs and reduced service life. The American Association of State Highway and Transportation Officials requested information from the states on this problem and 30 out of 36 responding indicated that they had a deck cracking problem. FHWA has prepared a draft document on the subject, "Synthesis: Bridge Deck Cracking, Facts and Fiction," and a new National Cooperative Highway Research Program study (12-37) will investigate the factors that contribute to this problem.

SHRP has increased the amount of research on nondestructive testing devices and methods for both new construction

and rehabilitation of existing pavements. At the 1991 TRB Annual Meeting, three sessions were held on backcalculation of pavement moduli and six other sessions were held on the use of new equipment and techniques for analyzing pavement distress. Two symposia will be held this summer: "Nondestructive Deflection Testing and Backcalculation for Pavements," and "State of the Art of Pavement Response Monitoring Systems for Roads and Airfields." Many new and different approaches are being developed, and the challenge will be to evaluate and implement them into state practice for both pavement design and management.

The new approaches may require skills and equipment not currently available in state departments of transportation, and may require the state to use outside agencies to collect data. States are also concerned about resources needed to complete SHRP's Long-Term Pavement Performance project.

AASHTO recently approved the conversion of the "AASHTO Guide Specification for the Seismic Design of Highway Bridges" to a Standard Specification and also updated the map in the specification with the 1988 U.S. Geological Survey Seismic Risk Map. As a result, some state DOTs are now required to consider seismic loadings in areas not heretofore included. Several states have indicated a need for further research in the seismic area, and there will be further evaluation of seismic design philosophy based on the Loma Prieta earthquake. There is also considerable work under way to put seismic design and retrofit information into practice. For example, the National Highway Institute is sponsor-

ing a training program to implement the latest technology in seismic design and retrofitting of highway bridges on a national basis.

## Materials and Construction

The use of quality control and quality assurance specifications is increasing as a result of in-house work-force reductions. These specifications place the responsibility for quality control on the contractor, with the states assuming a quality assurance role.

Because of the increasing volume of waste materials and by-products and the diminishing space in the nation's landfills, state transportation and highway agencies are being urged to investigate the use of these materials in highway construction. Agencies are evaluating such materials as fly ash, bottom ash, rubber tires, glass, solid waste incinerator ash, plastics, and foundry sand for use in pavements, embankments, and retaining walls. Major concerns are related to physical and chemical properties, performance, and cost-effectiveness in comparison with conventional materials. The states are also concerned about the effects these unconventional materials may have on the environment.

The industry is seeking safer and more accurate methods of determining the amount of asphalt cement in hot-mix asphalt. Ever since it was demonstrated that the chlorinated solvents used in determining asphalt content caused serious health and environmental effects, state agencies have been evaluating the use of biodegradable solvents, the nuclear asphalt

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6. Although pollution from automobiles has been reduced during last decade, number of miles of travel in urban areas has doubled.
7. Disposal of roadside litter is one environmental issue having economic impact on state maintenance programs.
8. Following Loma Prieta earthquake some states have indicated need for further research in seismic area.
9. Bridge scuppers are increasingly used to direct bridge runoff away from structural members and piers.

cement content gauge, and plant recordation as alternatives.

Rutting and stripping of asphalt pavements continues to be a problem for state highway agencies. More states are beginning to experiment with the use of large-stone mixes to minimize rutting.

States are interested in obtaining more reliable guidance in identifying alkali-reactive aggregate, reducing the reactivity of aggregate, and stopping alkali-silica reactivity from damaging existing structures and pavements. SHRP has recently published *Handbook for the Identification of Alkali-Silica Reactivity in Highway Structures*.

## Soils, Geology, and Foundations

An issue of great concern to states is the presence of hazardous and toxic substances in highway corridors. Better ways are needed to identify these areas during pre-construction surveys, immobilize these contaminants in place, and use contaminated material without compromising safety and environmental quality.

Lack of information on subsurface foundation characteristics for bridges has emerged as a significant problem. Such information is vital in assessing the stability of bridge superstructures, scour potential of bridge foundations, and susceptibility of bridges to damage during seismic activity. In addition, this information is an essential input to the rehabilitation strategy on

bridges. AASHTO has requested a study to address this need, and the fiscal year 1992 NCHRP program includes a project on the subject.

The use of geosynthetics is increasing, but more information is needed on durability, cost-effectiveness, and performance. In particular, information on failure mechanisms and selection of parameters for low-quality backfill materials is needed in the design of geosynthetically reinforced clayey soils, slopes, and walls. In August the TRB Committee on Geosynthetics conducted a conference on prediction of results of a full-scale load test on a geofabric wall.

## Maintenance

Considerable attention is being given to maintenance work zone safety, environmental issues, quality assurance programs, and use of personal computers in field units.

Protection of maintenance workers continues to be a high priority. Many agencies are increasing the use of truck-mounted attenuators on high-speed facilities. An increase in maintenance activities conducted at night in urban areas was reported

by several states because of the high traffic volumes experienced at other times. One state DOT recently purchased work zone traffic control kits at \$2,000 each and is selling them to local governments in the state at 10 percent of the original cost.

Environmental issues continue to have an economic impact on state maintenance programs. The major areas of concern include detection and repair or replacement of defective fuel tanks, containment and disposal of lead-based paints removed from bridge structures, proper storage and use of winter road salts, and disposal of roadside litter and debris.

The use of weather sensors and forecasting systems continues to assist managers in snow and ice control costs. Twelve-hour forecasts are being used to reduce patrol and stand-by expenses. One state reported savings of two to three hours in manpower and equipment time per storm by having accurate pavement temperature and weather information. Experiments with anti-icing techniques, designed to prevent ice from bonding to the roadway, may result in substantial savings in salt usage and labor and equipment resources required during winter storms.

Several states are implementing quality assurance programs to assess the consistency and level of service provided. One state is using a statistical sampling approach to develop a statewide assessment of the maintenance level of service.

Personal computers are being used in several departments to reduce the paper work burden on field supervisors created by the requirements of maintenance management systems. One state estimates that better scheduling techniques resulting from the use of personal computers could provide up to a 20 percent increase in productivity. Several states are also investigating automated means of integrating maintenance activity information with existing pavement management systems and new bridge management systems.

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## Traffic Operations and Safety

### Traffic Operations

Traffic congestion, air quality, and advanced technology are rapidly changing the way transportation services are provided. Traffic congestion that continues in many urban and suburban areas, coupled with the Clean Air Act and the financial hardships facing most states, is causing traffic engineers to seek alternative ways to add additional capacity within the existing right-of-way. Remedies that states are currently employing include more efficient use of existing pavements such as using freeway shoulders to add lanes during peak hours and reversible lanes on both freeways and arterial streets.

Traffic congestion that results from freeway incidents and emergencies is also a serious and growing problem. Typically, this nonrecurring congestion accounts 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. TRB is focusing on this topic through a series of one-day specialty conferences, "Traffic Management for Freeway Emergencies."

The research focus in traffic operations for the next decade and beyond will be on intelligent vehicle-highway systems. 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 (ATMS), advanced traveler information systems (ATIS), advanced vehicle control systems (AVCS), and commercial vehicle operations (CVO). These new technologies raise issues of hardware standardization and institutional questions about private sector

**10. Protection of maintenance workers continues to be high-priority concern.**

**11. Telecommuting is increasing in importance in many parts of the country.**

**12, 13. Safety features in various states include improved signs for pedestrians and older drivers.**



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and public agency roles in introducing such developments.

One of the major impediments to the implementation of IVHS is the absence of standards for IVHS technologies. For instance, the lack of standards for automatic vehicle identification (AVI) in the toll collection and trucking industries is resulting in the incompatibility of competing AVI systems. At least five states currently have automated toll collection facilities, and several more will soon be issuing specifications for regional or state-wide systems. Without AVI standards, vehicles may need different transponders in each state or region.

Although state-of-the-art urban traffic signal control systems are 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 currently available traffic-control hardware and software. This technology is readily available; however, public agency budgets and staffing are generally inadequate to design, install, and maintain all the elements of 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 IVHS technologies will require.

During the past several years, the need for managing traffic in freeway corridors, rather than on the freeway itself, has become increasingly apparent. The INFORM project on Long Island is an

example of this type of 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. These kinds of corridor projects, which control traffic on an integrated system basis using real-time data, 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.

The graying of America is also of concern to traffic operations personnel in various states. 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 recently implemented an older driver program that includes short-term operational improvements such as larger lettering on overhead and street name signs; wider pavement markings; and improvements in signs, markings, and pedestrian crossing times at signalized pedestrian crossings.

### Safety

The fatality rate declined to 2.1 deaths per 100 million vehicle miles in 1990. Although this is encouraging, there is some concern in the states that there is not a similar decline in serious injury accidents. An answer to this concern awaits further

collection and analysis of accident data. Although there appears to be progress in safety, the cost of traffic crashes is still high. National estimates are around \$74 billion for 1990.

National experience with air bags appears quite positive. The National Highway Traffic Safety Administration estimates that 2,400 lives will be saved from 1990 to 1995 and 29,000 moderate to serious injuries prevented during that time. Air bags will receive increasing attention as they become more widespread in the vehicle fleet.

Twenty-nine states have adopted administrative license revocation laws (ALR) as a DWI (driving while intoxicated) countermeasure. These have been shown to be cost-effective. Accident reduction effectiveness was studied in 17 states, and 6 states reported significant reductions in the rate of fatalities in alcohol-related crashes, ranging from 6 to 30 percent. The median decrease for the 17 states was 6 percent. Given this finding, an additional 346 lives could have been saved if ALR had been in effect in the remaining 21 states in 1989.

For the past several years there has been relatively little discussion of a major traffic safety problem: the young driver. Occupant restraint and alcohol programs have included the younger driver but states have generally decreased novice driver education efforts. The National Highway Traffic Safety Administration is refocusing on this area. Maryland and California conducted demonstration projects of provisional licensing programs. These programs included emphasis on completing classroom and behind-the-wheel driver education, improved licensing and testing procedures for novice drivers, adult-supervised driving practice during high-risk hours, demonstrated safe driving performance, and parent certification of specific types of driving practice. Evaluation found a 5 percent reduction in fatal crashes for Maryland's 16- to 17-year-old drivers and a 5.3 percent reduction for California's 15- to 17-year-old drivers.

Motorcycle helmet laws continue to be controversial politically; however, their fatality countermeasure potential has been clearly demonstrated. According to

NHTSA, helmet use reduces motorcycle fatalities by 29 percent. From 1982 to 1987, 4,645 lives were saved in states with helmet laws in effect. Another 2,500 lives could have been saved if helmet laws had been in place in all states.

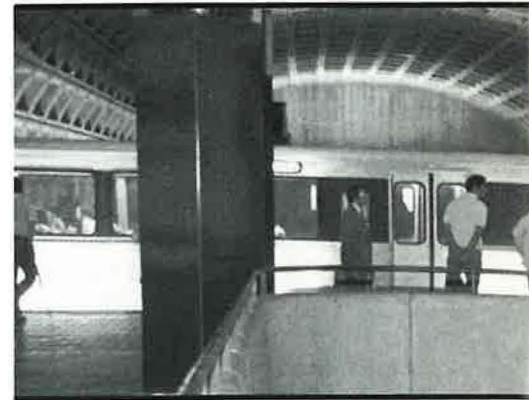
Safety research was examined in 1990 by the TRB Committee on Strategic Transportation Research Studies—Safety. The final report, published as *TRB Special Report 229: Safety Research for a Changing Highway Environment*, emphasized the need for changes in safety research focus, contracting mechanisms, and funding. To continue the current progress in improved safety, longer-term basic and applied research is needed. The Committee particularly targeted crash avoidance as a potential area for research.

## Transit, Aviation, Rail, and Water Transportation

### Transit

The lack of a dedicated source of funding that ensures a reliable and stable flow of funds continues to be a major problem for most transit agencies. Because of this uncertainty, any systematic planning for the future, even for next year's operation, is extremely difficult. As never before, the major public and private transit interests have formed a national coalition to raise the awareness of elected officials and the public at large to support transit programs at the national, regional, state, and local levels.

During the 1980s, privatization of public-provided service was one of the federal government's principal goals. As a result, in a 10-year period, competitive contracting of bus services grew from almost nothing to about 10 percent. In 1979 only one large metropolitan area contracted for transit service. By 1990 many of the large transit systems competitively contracted a portion of their services, some as much as 20 percent of their regular service. Although a number of studies have found that privatization of services has resulted in substantial savings, some contend that the analyses do not represent the true picture and that the savings are overstated. Although competitive contracting has not



14

resulted in any layoff of transit workers, organized labor opposes the practice.

In large metropolitan areas many transit agencies are cooperating with other public bodies and the private sector in addressing the pressing issue of congestion. They participate with transportation management associations to find better ways to balance the demand and supply sides of travel, and there is some interest in applying new technology for pretravel information, fleet management, and transit operations.

Since the Americans with Disabilities Act of 1990 was enacted, numerous questions have been raised about the application of the transportation provisions of this sweeping legislation. Such issues as equivalent level of service, eligibility criteria, and "equal to or comparable with accessible fixed-route service" will have to be addressed by transit agencies immediately. Some transit agencies anticipate considerable adjustments to the services they are now providing.

Major changes occurred in 1990 in the federal transit planning and research program. In the past, funding for these Urban Mass Transportation Administration programs was relatively low and subject to annual fluctuations. Under the Administration's new proposal, 2.8 percent of the UMTA appropriation would be set aside as a consolidated, single federal funding source for planning and research programs. Of particular significance to TRB is the proposed Transit Cooperative Research Program (TCRP), which would be funded at about \$10 million in the first year. At this time, preliminary discussions indicate that the



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TCRP governing board would most likely be housed in the Transit Development Corporation and the day-to-day program management would be performed by TRB.

### Aviation

*Economic and Political Climate:* The past year was a difficult period for the airline industry. The economy was sluggish throughout 1990 as real GNP growth slowed to just over 1 percent. The airline industry proved somewhat stronger than expected under such conditions and managed to remain marginally profitable through the summer of 1990. However, with the Iraqi invasion of Kuwait in August and the rise of world oil prices, the U.S. airline industry posted losses of \$2 billion for 1990. For the first half of 1991, U.S. airlines collectively lost an additional \$2 billion.

Increased fuel cost was but one of several factors depressing the airline industry. The fear of terrorism also played a part. The outbreak of hostilities in Kuwait and Iraq led to a 50-percent drop in international traffic and an 8-percent drop in domestic traffic—a trough out of which the airlines are still climbing. The continuing recession depressed air travel to the point that the Federal Aviation Administration now forecasts that annual domestic revenue passenger enplanements in 1991 will drop by 1 percent.

*Airline Industry Structure:* The economic hardships of the past year have had differing effects on individual carriers. Hardest hit were those already in financial difficulty. Eastern Airlines, Pan Am, TWA, and USAir

reported combined net losses of more than \$1.4 billion in 1990. Eastern and PanAm are in bankruptcy. TWA has begun selling off its international routes, and USAir has severely reduced its work force and cut back its operations. Joining the list of Chapter 11 carriers in 1990–1991 were Continental Airlines, Midway Airlines, and America West. The Trump Shuttle is not expected to survive long, and TWA may face bankruptcy within a year.

At the other end of the spectrum, the most profitable carriers have strengthened their positions. American Airlines, Delta Air Lines, Northwest, and United Airlines together had net profits of more than \$900 million in 1990 and now have well over half of the market. All are seeking to expand their overseas routes and establish themselves as global carriers.

*International Developments:* Events in Europe and the Far East may hold the key to the future evolution of the airline industry. U.S. carriers seeking to buy routes to the United Kingdom being offered for sale by Pan Am and TWA are encountering stiff opposition from the British government.

This may be a harbinger of a much larger and more serious resistance to overseas operations by U.S. carriers as the European Community (EC) approaches economic union in 1992. The EC has already served notice that it will consider route rights now granted under bilateral agreements between the United States and EC member states to be subject to renegotiation after 1992. This opens the issue of cabotage, and it could be that future access to European airports and markets can be secured by the United States only if it opens its domestic markets by establishing new gateway airports and allowing EC carriers to transport passengers and cargo within this country.

- 14. Major public and private transit interests have formed a national coalition to support transit programs.
- 15. Increased fuel cost is one of several factors depressing airline industry this past year.
- 16. Staff field visits include those to private research organizations such as 3M Center in Maplewood, Minnesota.

The transpacific market is the most rapidly growing segment of international aviation. Passenger demand between the United States and the Pacific Rim has more than doubled since 1985 and is expected to grow at 9 percent annually over the remainder of this century. Three factors are responsible: strong economic growth in the Pacific Basin, an increase in route authorities granted to U.S. carriers by Japan in 1990, and decline of the U.S. dollar relative to the Japanese yen (both historic and anticipated).

**Consumer Effects:** In real terms, airline fares have declined steadily since airline deregulation in 1978. Average ticket prices in 1990 were about 20 percent lower in constant dollars than they were a decade ago. At the same time the availability and frequency of air service, on average, has improved. There has also been no measurable degradation of safety despite the increasing number of flights, passengers, and miles of travel.

The cost picture may change. Recent legislation would permit airports to levy a head tax (passenger facility charge) on enplaning or transferring passengers to raise funds for capital projects to expand airport capacity. Also under consideration are measures that would increase the cost to airlines (and ultimately passengers) for use of the airport at peak periods, known as peak-hour or congestion pricing. Airlines themselves may have to increase fares to meet higher fuel costs, to cover the cost of replacing aging fleets, or to expand service.

**Airport Capacity:** One of the most contentious issues facing the aviation industry is providing adequate airport capacity to meet the needs of future air travel. Congestion and delay at major U.S. airports, particularly those serving as airline hubs, have reached critical levels. Last year 21 major airports experienced 20,000 hours or more of flight delays in air carrier operations. By the end of this century, 39 U.S. airports could be so affected. With the exception of the new airport now under construction in Denver, no new airport has been built in this country for 20 years; and several projects to build new airports or expand existing facilities are on hold for lack of funding or because of community protest about air-

craft noise. Recent policy initiatives by the U.S. Department of Transportation and the Federal Aviation Administration seek to set effective and equitable standards for permissible noise levels on a uniform national basis, thereby preempting locally imposed noise reduction measures.

The cost of building a new major airport can run to perhaps \$4 to 6 billion plus a similar sum to provide ground transport systems for airport access. The burden of raising these funds falls primarily on local governments, with assistance from the

## Rail

From the standpoint of the states, rail-related issues of greatest concern continue to be preservation of essential rail freight services and development of rail passenger services. Rail freight services, particularly on lines with light traffic density, continue to be threatened by abandonments. Many states with economies heavily dependent on rail services have analyzed lines that are candidates for abandonment to determine where state assistance would be appropriate.



17

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states in some cases. Federal grants are also available, but the current moves toward fiscal austerity in the federal budget may shift a greater share of the funding to state and local governments. They, too, face growing budget deficits, and in the long run the availability of adequate airport capacity will depend on how much the general public and users of the air transport system are willing to pay for high quality, efficient, and safe travel.

Over the past decade, nearly half the states have spent their own (in addition to federal) funds on rail freight preservation projects, but most of the state programs lack a predictable funding base and tend to receive less attention than the much larger highway programs. Planning and investment decisions are usually made independently along modal lines, and are often economically inefficient. To address this issue, work by a group of state rail planners laid

the groundwork for a new NCHRP research project to develop a multimodal framework for freight transportation investment that would take into consideration rail and highway investment trade-offs.

Conventional intercity and commuter rail passenger services are seen as solutions to congestion problems in a growing number of states. Last summer California voters approved a multi-billion dollar bond issue to fund expansion of intercity (Amtrak), commuter rail services, and urban rail transit. Several other states are working with Amtrak to extend and enhance existing intercity services.

High-speed rail and maglev systems are being studied for a number of corridors, but funding for construction and operation continues to be the major hurdle to implementation. Florida's maglev demonstration project, essentially a private project, appears to be proceeding. The National Maglev Initiative, a cooperative venture by the Federal Railroad Administration, the U.S. Army Corps of Engineers, and the U.S. Department of Energy, has begun a major research program to determine both the technical and economic feasibility of developing a maglev industry in the United States in the next 20 years.

From the standpoint of the railroad industry, improving the quality of service is driving investment in new technology to improve operations. Competitive pressures from other modes, primarily trucking, and demands from customers for more reliable services, have put more emphasis on cost containment. For example, maintenance managers are increasingly looking for ways to prolong the useful life of existing track materials and to use new longer-life materials. They also recognize the need to minimize the amount of time required to access tracks for maintenance activities and are coordinating with operations staff to facilitate meeting customer demands for set time schedules.

New investment in advanced train control systems (using satellites and transponders) is one example of how the industry is taking advantage of new technology to improve operations, and the resulting possibilities to provide higher-quality service are just being realized. Railroads are

also benefitting from investment in automatic equipment identification, electronic data interchange, and improved car management systems.

### Water Transportation

The nation's water transport system is composed of a widely divergent array of public and private interests. Inland waterway carriers, Great Lakes carriers, and international steamship companies carry the nation's foreign and domestic commerce and are therefore subject to various international, national, and local regulations. The waterborne carriers and the landside transport systems with which they connect demand an efficient water transport system and face a host of challenges.

From an intermodal perspective, marine terminals present the most familiar component of the water transport chain. Ports serve as interchange points with connecting landside transport systems; 30 coastal states host 1,900 deep-draft port facilities of varying size, and 21 states accommodate some 1,700 public and private inland water port facilities. In 1988 the Maritime Administration, using its National Input-Output Model, calculated that the total direct, indirect, and induced impact of the entire shal-

low and deep-draft port industry accounted for \$98 billion in sales of service.

The Desert Storm experience refocused attention on the military role of ports and the U.S. flag fleet. The decline of the U.S. merchant marine fleet continues to be an issue of national policy debate. The war in the Middle East also refocused the question of both adequacy and accessibility of port and vessel capacity to concurrently accommodate military and commercial demands.

Financing issues confront the maritime transport system at all levels. To sustain channel depths and waterway infrastructure operation and maintenance, user fee charges have proliferated. During the past decade almost a dozen user taxes have been implemented or are under active debate. Most recently, the Oil Pollution Liability Act of 1990 confronts vessel operators with a new assessment structure.

The appropriate level of cost sharing that ports, waterways, and vessels can sustain is  
*continued on page 46*

**17. Conventional intercity and commuter rail passenger services are seen as solutions to congestion in a growing number of states.**

**18. Ferry operators are grappling with a growing list of environment, safety, and operational issues.**

18



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