

INNOVATION IN TRANSIT RESEARCH AND TECHNOLOGY

Federal Transit Administration

M. MARINA DRANCSAK AND HENRY A. NEJAKO, JR.

M. Marina Drancsak is Transportation Management Specialist and Henry A. Nejako, Jr., is Program Management Officer, Federal Transit Administration, U.S. Department of Transportation.

The Transportation Equity Act for the 21st Century reaffirms the federal government's commitment to America's mobility by providing record levels of investment to continue the rebuilding of U.S. highways, transit systems, and intermodal facilities. The new legislation reflects the view that transportation is about more than concrete, asphalt, and steel. It is also about people, mobility, and accessibility—providing all citizens with the opportunity to lead safer, healthier, and more fulfilling lives. Strong emphasis is placed on the importance of research and innovative technology if maximum benefits are to be reaped from new infrastructure investments. Funding for transit research and technology is guaranteed under TEA-21.

The new legislation builds on the initiatives established under the Intermodal Surface Transportation Efficiency Act of 1991. ISTEA not only opened up a new era of intermodalism, but also introduced the idea of a national transportation system more responsive to citizen input. TEA-21 combines continuation and improvement of current programs with new initiatives to meet the challenges of improving safety, protecting and enhancing communities and the natural environment, creating opportunities for all Americans, and advancing America's economic growth and competitiveness both domestically and internationally through efficient and flexible transportation. Following is an overview of the basic TEA-21 changes and new initiatives incorporated into the Federal Transit Administration's Research and Technology Program.

FTA Research and Technology Program

The mission of FTA's Research and Technology Program is to partner with the transportation industry

in establishing the preeminence of U.S. transit technology, institutions, and customer services, with the ultimate goal of increasing the quality and level of transit services. The program's core effort is the deployment of technological innovations to improve personal mobility, minimize fuel consumption and air pollution, increase ridership, and enhance the quality of life of all communities. Emphasis is placed on mainstreaming proven cost-effective technological innovations through FTA planning and capital assistance programs. Primary target areas are major investment planning, bus operations, clean fuels, new-start projects, and professional capacity building. The TEA-21 investment in research and technology provides FTA and its partners with the resources needed to carry out this mission, and thereby supports the U.S. transportation system's safety, efficiency, and capacity to contribute to the achievement of national goals.

FTA's Research and Technology Program is consistent with the strategic plans of both the U.S. Department of Transportation and FTA for 1998–2002. The focus is on developing and utilizing an educated, skilled, and diverse workforce, along with the latest information management and technological advances, to fully exploit the benefits of transit. TEA-21 provides an average of \$47 million annually for the FTA Research and Technology Program. These resources will fund the development of innovative transit technologies, such as bus rapid transit (integrating vehicle and intelligent transportation systems technologies), safety-enhancing commuter rail control systems, hybrid electric buses, and fuel cell and battery-powered propulsion systems.

The program also includes FTA's safety projects and policy studies, as well as the implementation of transportation planning techniques and policies designed to further transit-oriented land use. These resources provide ongoing support as well

for the Transit Cooperative Research Program, which focuses on meeting the direct research needs of the transit industry, and the National Transit Institute, which works to meet the industry's training needs.

Today, information generated through research and the introduction of cost-effective technology provides unprecedented opportunities to increase transit ridership and reduce the capital, operating, and maintenance costs of services and facilities. TEA-21 includes a number of new research and technology initiatives. Among these are the Joint Partnership Program for Deployment of Innovation, the International Mass Transportation Program, programs focused on advanced bus technologies and testing of new-model buses, ITS applications, and two research and development projects addressing low-speed magnetic levitation for urban transportation.

Joint Partnership Program for Deployment of Innovation

Under this new TEA-21 public-private joint partnership program, FTA will work with industry and other government and private research entities to accelerate the deployment of innovative technologies in the mass transit industry. The program will be carried out in consultation with the transit industry by competitively selected consortia that will share the costs, risks, and rewards of early deployment of innovations. Consortia entering into partnership agreements with FTA will provide at least 50 percent of project costs.

Each consortium must include at least one provider of transit service to the public and one or more U.S. businesses offering goods or services to transit operators. In addition to grants, contracts, and cooperative agreements, FTA may enter into other agreements tailored to the circumstances of the particular innovation.

International Mass Transportation Program

The goal of this new program is to strengthen the nation's economy by making American transit products and services competitive in the international marketplace, and by participating in the international exchange of transit resources and ideas for improving the performance of the American transit industry. In pursuit of this goal, FTA will enter into memoranda of understanding with other government agencies, foreign governments, and transit agencies to undertake joint partnerships and cooperative research and technology projects designed to provide for the international exchange of professional practices, industry standards, and equipment and technology developments.



Advanced-technology transit bus features light weight, low floor, low emissions, and on-board computer management system.

Advanced Bus Technologies

TEA-21 continues the development and deployment of environmentally friendly vehicles. Like ISTEA, which included an advanced electric vehicle technology program and provided funds for initiatives such as the fuel cell transit bus and advanced-technology transit bus, TEA-21 funds the development and deployment of advanced bus technologies. Specifically, TEA-21 provides \$4.85 million annually for the Fuel Cell Transit Bus and Bus Facilities Program, aimed at demonstrating the viability of fuel cells as an effective power source for transit vehicles. These funds will be used for the development of lighter-weight and more powerful fuel cell buses, fuel cell bus maintenance facilities, and technology training programs. The advanced fuel cell bus will be twice as efficient as a typical diesel bus, but without the range limitations of battery-powered buses. In partnership with the U.S. Department of Energy and the Defense Advanced Research Projects Agency, FTA developed energy-efficient, low-emission bus propulsion systems based on two types of fuel cell technology. Currently, a commercially viable 40-foot phosphoric-acid fuel cell bus is being demonstrated, and a more advanced liquid-fueled, proton exchange membrane fuel cell, designed for transit bus applications, is under development.

TEA-21 also provides for a new Clean Fuels Formula Grant Program designed to accelerate the deployment of advanced bus technologies. This program offers an opportunity to incorporate low-emission vehicles into the mainstream of the nation's transit fleets and supports FTA's efforts to advance emerging clean-fuel technologies.

Funds are provided as well for the deployment of new bus technologies such as the advanced-technology transit bus, which FTA developed in partnership with the transit industry. This new bus

is more than 10,000 pounds lighter than a typical 30,000-pound bus. Savings from weight reduction include lower fuel costs and less road damage. The low-weight bus also incorporates a highly efficient fuel-saving drive system, aerospace construction, accessible design, and hybrid-electric propulsion into a single vehicle design. Testing of prototype buses in regular service began during 1997.

Bus Testing Facility

TEA-21 authorizes \$3 million per year for testing of new-model buses. The FTA Bus Testing Program is designed to promote the production of better transit vehicles and components, and ensure that FTA customers purchase safe vehicles able to withstand the rigors of transit service. Under this program, FTA provides 80 percent of the cost of bus testing to the Pennsylvania Transportation Institute, the operator of the Bus Research and Testing Center; the matching 20 percent is paid by the bus manufacturer or entity that is having the vehicle tested.

The Bus Research and Testing Center, located in Altoona, Pennsylvania, currently tests buses for safety, structural integrity, durability, performance, maintainability, noise, and fuel economy. Test results are compiled into a comprehensive report available to the public. FTA funding recipients

must certify that they have a test report before taking delivery of any new-model bus. Currently, the center is expanding its facilities to accommodate additional tests. When all modifications have been completed, the center will have facilities capable of testing vehicles that use gasoline, diesel fuel, compressed natural gas, liquefied natural gas, methanol/ethanol, propane, and battery-powered electricity.

ITS Funding

TEA-21 reauthorizes the ITS Initiative. A total of \$1.282 billion in contract authority for fiscal years 1998–2003 is provided to fund the ITS program. Of this total, \$679 million is targeted to transportation systems integration, and \$603 million to research, training, and standards development to accelerate the integration and interoperability of computerized control, communications, and information systems in both metropolitan and rural areas.

The focus of the metropolitan area ITS program is on the inclusion of transit as a key component of the regional infrastructure in order to help create systems that will benefit transit operations and link them to the operations of other agencies. A new section of TEA-21 authorizes ITS technology applications involving fixed guideway technology, bus technology, and advanced propulsion control systems.

ITS technology is being incorporated into the existing transportation planning process with its traditional funding sources to provide a foundation for achieving the goals of multimodal integration and interoperability. At the same time, other sources of funds are available for ITS deployment. Both National Highway System and Surface Transportation Program funding may be used for infrastructure-based ITS capital improvements. Congestion Mitigation and Air Quality Program funds may be used for the implementation of ITS strategies designed to improve traffic flow. In addition, transit-related ITS projects are defined by TEA-21 as capital projects, and are therefore eligible for FTA funding.

Bus Rapid Transit Initiative

The new Bus Rapid Transit Initiative is aimed at demonstrating, in partnership with local entities, how a combination of vehicle and ITS technologies, traffic engineering, and urban design enhancements can significantly increase speed and ridership and reduce travel time, operating costs, and emissions. The program is focused on providing an integrated, well-defined transit system with operating speeds and service reliability comparable to those



Traveler information kiosks are an example of the growing number of products and capabilities resulting from research in intelligent transportation systems.

of rail transit. FTA is launching the program to improve the speed, reliability, and convenience of bus service, as well as enhance the mobility and access needed to foster thriving communities and promote a healthy environment. Program elements include the planning, design, and implementation of separate bus lanes, streets, and busways; bus signal preference; low-cost traffic engineering improvements and faster boarding through innovative fare collection; and platform design for quicker bus boarding and departure.

Low-Speed Magnetic Levitation for Urban Transportation

Numerous studies have been conducted to explore the cost and feasibility of high-speed (up to 300 mph) magnetic levitation (MAGLEV) systems. At the same time, continuing traffic congestion and relatively stagnant rail technology have stimulated interest in the potential of low-speed (below 75 mph) MAGLEV systems as an alternative to existing rail technologies. TEA-21 establishes two low-speed urban MAGLEV research and development projects: the Low-Speed Project and the Advanced Technology Pilot Project. Research will be conducted to identify relevant technologies and demonstrate the energy efficiency, congestion mitigation, and safety features of a low-speed urban MAGLEV system. The research will also include the development of low-speed superconductivity magnetic levitation technology for public transportation in urban areas. After one or more feasible low-speed technologies have been developed, demonstration and commercial phases of the project may be planned and initiated.

Professional Capacity Building

TEA-21 includes funding for three major programs—the Transit Cooperative Research Program, the National Transit Institute (NTI), and the University Transportation Research Program—that will constitute the majority of FTA's efforts in the professional capacity building program area. Those efforts are focused on attracting, training, and retaining a high-quality transit workforce better prepared to deal with the challenges of new technology. Following is a short discussion of these three programs and the changes that have taken place as a result of TEA-21.

Transit Cooperative Research Program

TEA-21 reauthorized TCRP for the next 6 years at not less than \$8.25 million annually. The program will continue to promote transit operating effec-

tiveness and efficiency by assisting the industry in developing and applying the latest technology and operating techniques designed to improve mobility and accessibility. The needs of the transit workforce are being addressed through innovative research, education, and information exchange. TCRP products, such as new transit paradigms, transit industry best practices, and new planning and management tools, as well as forums for the exchange of ideas, are being used to develop and equip a quality transit workforce with the resources necessary to meet the challenges and opportunities of newly developed and deployed technologies.

TCRP will continue to be guided by a Transit Oversight and Project Selection Committee representing all aspects of the transit industry. This is the only national program in which the transit industry has direct responsibility for setting the research agenda.

TCRP was established under FTA sponsorship in July 1992 to provide the transit industry with resources for the development of innovative near-term solutions to meet transit demands. The program was authorized as part of ISTEA. A memorandum agreement outlining TCRP operating procedures was executed by three cooperating organizations: FTA; the National Academy of Sciences, acting through the Transportation Research Board; and the Transit Development Corporation, Inc., a nonprofit educational and research organization established by the American Public Transit Association.

National Transit Institute

NTI is reauthorized for another 6 years by TEA-21, with an increase in funding from \$3 million to not less than \$4 million annually. Workplace safety and innovative financing are added to the recommended subjects to be addressed, with not more than \$1 million to be available for workplace safety.

The increase in funding for NTI resulted from efforts by organized labor to support training targeted at improving safety in the workplace. Future efforts will continue to focus on identifying and supporting needed managerial, technical, and professional development in the transit industry. NTI was authorized by ISTEA and established in 1992 at Rutgers, The State University of New Jersey, to provide training and education programs for the transit industry. The institute develops and teaches new methods and techniques for improving transit workforce performance and increasing productivity in the workplace. Courses are conducted at sites nationwide on a broad range of subjects, from advanced technology and multi-

modal planning to management development and training effectiveness.

University Transportation Research Program

Under TEA-21, the University Transportation Research Program has expanded in the number of universities participating, the level of funding, and the addition of education and technology transfer as primary program elements. All schools involved in the program will be required to provide a 50 percent match regardless of their level of funding.

Starting in fiscal year 1999, there will be 33 universities participating in the program, each receiving from \$300,000 to \$2 million annually. U.S. DOT will provide up to \$33.25 million each year; of that amount, \$6 million will come from transit funding.

Transit funds will be used to support centers at the University of Minnesota, Northwestern University, Morgan State University, and North Carolina State University. Although the funds are made available from highway and transit funding accounts, the language in TEA-21 puts emphasis on the development and conduct of research and education that are both interdisciplinary and multi-modal in nature.

The Research and Special Programs Administration will continue to manage this program on behalf of U.S. DOT. Direct input will be provided by the participating modal administrations relative to their research and educational interests at the participating schools.

Other Areas

TEA-21 introduces changes and new programs in a number of other areas, including transit research discussion and dissemination, welfare to work, funding for preventive maintenance, the transportation planning process, and transit benefits.

Transit Research Discussion and Dissemination

The new legislation continues funding for transit research discussion and dissemination. FTA continues to support TRB activities, thus providing a forum for transit professional capacity building. The impact of this FTA support is substantial and has many direct and indirect benefits. TRB has more than 20 standing committees that discuss and disseminate transit research. These committees (collectively with about 400 members) comprise the leading transit experts in North America and the world.

Other TEA-21 changes and new programs provide for research on and deployment of innovative transit technology.

Welfare to Work

TEA-21 creates a new program called Job Access and Reverse Commute Grants. This program is funded for fiscal years 1999–2003 with \$400 million from the Mass Transit Account and an additional \$350 million from the General Fund. The purpose of the program is twofold: (1) to develop services for transporting welfare recipients and low-income individuals to and from jobs, and (2) to develop general-purpose public transportation services to transport residents of urban, rural, and suburban areas to suburban employment opportunities.

One of the key selection criteria for this new program is the use of innovative approaches. These approaches might include ITS technologies, such as computer-aided dispatching, electronic fare payment, and customer information systems to ensure coordinated services. Eligible grant recipients include local governmental authorities and agencies, transit operators, and nonprofit organizations.

Funding for Preventive Maintenance

TEA-21 amends the general definition of a capital project to encompass several new items, including preventive maintenance. Preventive maintenance costs are defined as all maintenance costs and are now eligible for FTA capital assistance, so that fiscal year 1998 and subsequent fiscal year appropriations may be used for this purpose. For large transit systems, this means that federal matching for preventive maintenance expenses is now 80 percent instead of the 50 percent that obtained previously under operating assistance.

Transportation Planning Process

A key change in the new legislation is the consolidation of 16 metropolitan and 23 statewide transportation planning factors into seven broad factors to be considered in the planning process, at both the metropolitan and statewide levels. The growing importance of operating and managing the transportation system is recognized as a focal point for transportation planning. TEA-21 research funds support the development and evaluation of more effective and timely methods and tools for planning and designing transit system improvements.

Transit Benefits

The increasing use of electronic fare collection will facilitate the changes made by TEA-21 in the transit benefits program. The new legislation increases the tax-free limit on employer-provided transit benefits from \$65 to \$100 per month beginning in 2002.

continued on page 39

Research and Technology

continued from page 5

needs of the nation. The United States should be leading the development of a world-class transportation R&D capability. This can be accomplished by sharing information across transportation S&T networks; by leveraging resources and forming public-private partnerships; and by supporting the important foundations of long-term research and investment in education and training in math, science, and technology.

Transportation is undergoing a technology revolution: the transportation system of the 21st century will adapt to people. Technology is key to accomplishing the ultimate goal of a safe, accessible transportation system that enhances the natural and human environment, supports the nation's domestic economy and international trade, and protects our national security. TEA-21 will help us achieve this goal.

Meeting the Challenges of Highway Safety

continued from page 25

to provide information on driver improvement and testing, fraudulent ID detection, and graduated licensing.^b NHTSA regional offices also will be able to expand technical assistance to states in program evaluation and data analysis. Additional funding provided by TEA-21 will be used to improve the documents accepted by federal agencies for identification purposes.

^b Graduated licensing is a three-tiered licensing system comprising a learning permit, a restricted license period, and then graduation to a full nonrestricted license.

NOTE: *The following individuals contributed to the preparation of this article: Joseph Kianthra, Rolf Eppinger, William Hollowell, Duane Perrin, Keith Brewer, August Burgett, and Patricia Breslin, Office of Research and Development, and James Fell, Office of Traffic Safety Programs, National Highway Traffic Safety Administration, U.S. Department of Transportation.*

Innovation in Transit

continued from page 12

Transit benefits are a provision of the Internal Revenue Code that permits an employer to pay for an employee's cost of commuting to work by transit or eligible vanpool. This provision is designed to improve air quality, reduce traffic congestion, and conserve energy by encouraging employees to commute in other than single-occupancy vehicles.

Prior to TEA-21, the Internal Revenue Code allowed employers to provide only transit or vanpool benefits in addition to and not in lieu of compensation. Under TEA-21, effective January 1, 1998, transit and vanpool fringe benefits can be provided in addition to compensation, in lieu of compensation, or a combination of both, up to the maximum limit.

Conclusion

In conclusion, accomplishing the goals of FTA's research and technology programs will depend on the agency's ability to form partnerships with public- and private-sector organizations willing to join in leading the transit innovation process. Many activities will require commitments of staff and funds from sponsoring partners, as well as from FTA and other federal agencies. Clearly, the federal government has a vital interest in funding transit research and innovative technologies. Transit increases basic mobility for millions of Americans, provides congestion relief, and promotes livable communities. TEA-21 affirms that transit is a critical element of the nation's transportation system.

Readers are encouraged to visit the FTA Web site at <http://www.fta.dot.gov/library> for additional information on transit and TEA-21.