Technology Development

PROGRAM

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Technical Assistance Brief

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IN THISISSUE

Overview

The FTA Technology Development Program is vital to sustaining the National policy goals of promoting innovation and technological advances to meet the transportation requirements of the 21st century. The Technology Development Program seeks to optimize the use of capital investments to improve the efficiency of high capacity travel options such as fixed guideways, bus systems, waterborne transit, Magnetic Levitation, or HOV lanes and to assist in the introduction of new technology into transit systems.

Fixed guideway systems consist of rapid rail, light rail, commuter rail, and various types of automated systems. Bus systems include conventional buses and advanced buses with low floor access, composite material bus bodies, an alternative fueled propulsion systems. Automated systems, such as MAGLEV, feature sophisticated propulsion and suspension methods.

The Technology Program has been developed through a series of aggressive outreach efforts that ensure that industry needs and priorities remain an integral part of the overall FTA effort. A newly established Federal Technology Advisory Committee, comprised of transit suppliers, manufacturers, operators, consultants, and academic institutions, meets to recommend industry technology priorities, emphasis areas, and cost-sharing ideas. Planning and Research Priorities Workshops are regularly sponsored by the Office of Technology and Safety to determine transit industry needs.

In the years ahead, the demand for new systems, line extensions and major infrastructure rebuilding projects will increase. This increased activity in transit construction and service will lead to an increased demand for improved technologies that reduce costs, improve environmental acceptability, and system reliability. State and local officials will need technical assistance and access to new construction technologies for rail and bus facilities, vehicle designs, signal systems, information systems, engine designs, propulsion systems, as well as information on the cost-effectiveness of various transit modes. Research and demonstrations of state-of-the-art and state-of-the-practice innovations will provide the impetus to the transit industry to implement these innovative technological advances.

Advanced Technology Transit Bus (ATTB)

The ATTB program provides the opportunity to develop low-floor, light-weight vehicles that will become the basis for a new industry standard. It is intended that these buses will significantly reduce the cost of operation and increase user convenience and comfort.

❑ Background

FTA's ATTB program derives its impetus from Federal, state, and local legislation and programs. The leading Federal legislation shaping the ATTB design are the Americans with

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(ATTB)

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Disabilities Act (ADA) of 1990, the Clean Air Act (CAA) Amendments of 1990, the Energy Policy Act (E-PACT) of 1992, and Section 27, Title 23 of the United State Code (USC). Each of the above laws and their implementing regulations have a varying degree of influence on ATTB design.

o What the Laws and Regulations Mean to ATTB Design

Over-weight Buses

The Federal Highway Administration (FHWA) administers the section of the USC pertaining to the maximum allowable axle weight for vehicles using the Interstate System of Defense Highways. The FHWA weight limit for a single axle is 20,000 lbs. 'This limit has also been adopted by most states. Currently, all 35 foot and 40 foot, heavy-duty, 12-year, transit buses exceed the 20,000 lb limit on their rear axle with a full seated passenger load, the overload amount obviously increases when standees are included. 'The issue of transit bus over weight rear axles has come to the forefront recently due to State and local law enforcement agencies prosecuting transit agencies for their overweight vehicles.

In order to comply with the FHWA regulation for maximum axle weight, the ATTB curb weight will have to be reduced some 4,000 to 10,000 lbs when compared to current transit bus designs. Reducing sub-component weight alone will not generate the weight reductions required. To achieve these large weight reductions, the ATTB will have to be redesigned from the ground up.

Mild steel and stainless steel is currently the construction material of choice in the transit bus manufacturing industry, mostly because the materials are inexpensive and easy to work with. However, for their strength they are quite heavy (a low strength-to-weight ratio). New materials such as high-strength steels, carbon fiber (graphite) composites, aluminum, and various types of metallic and non-metallic honeycomb sandwiches have equivalent strength and a considerably lower weight (a high strength-to weight ratio).

Generally speaking, the aerospace industry has the largest experience base in the use of these high-strength, lightweight materials. The ATTB will need to be constructed from a combination of these high strength-to-weight ratio materials so the required weight reductions can be achieved.

A direct benefit from the lower weight will be a significant increase in fuel economy, a decrease in the power, size of the ATTB propulsion plant, and weight lower total exhaust emissions.

Alternative Fuels

The Clean Air Act and the Energy Policy Act have similar impacts on the transit community with regard to ATTB design. 'The CAA, through the Environmental Protection Agency's (EPA) implementing regulations, requires increasingly lower engine exhaust emissions levels t-rom transit buses. It is expected that the use of alternative fuels will lower bus emission levels turther than the levels presently achievable by diesel fueled buses.

E-PACT promotes the use of alternate fuels in transit bus applications for a different reason than the CAA. E-PACT's premise is to decrease the Nations dependence on foreign supplied petroleum fuels such as methanol, ethanol, natural gas and propane. The use of alternate fuels in the transit industry will require new engine designs, safety and handling procedures, training guidelines, fueling facilities, and bus storage tank designs, to name a few.

Some States have even more specific and stringent laws regarding alternate fuel usage and exhaust emissions. Specifically, Texas requires that transit buses be powered by either compressed natural gas (CNG) or liquefied natural gas (LNG), and California' s ultra-low and zero emission vehicle laws basically exclude diesel as a potential fuel with current engine technology.

Alternate fuels exhibit promise in lowering transit bus exhaust emissions to a level that will comply with future EPA requirements. However, alternate fuel use in transit buses will have an effect on one or more of the following features, as compared to a standard diesel powered bus: higher bus weight, less passenger space, less machinery space, lower operating range, new fueling and storage facility construction, and possible fuel handling concerns. All of these factors must be considered when designing the ATTB.

Accessibility

The Americans with Disabilities Act (ADA) will have the greatest impact on the physical appearance of the ATTB, and will impose some unique and beneficial design requirements. The ADA implementing regulations require that new buses procured by transit agencies be accessible to persons with disabilities, including those in wheelchairs. The DOT regulation specifies that a wheelchair ramp or a wheelchair lift's will be required for this purpose.

However, a wheelchair ramp is the only device that will allow a person with such a disability to attain true accessibility to the bus. Wheelchair lift's are too cumbersome to operate, time consuming to repair, and require a higher level of maintenance to operate efficiently and effectively. A wheelchair ramp is the device of choice to ensure the greatest possible accessibility for persons in wheelchairs. The DOT' regulation also specifies different ramp slopes for varying heights of the bus floor above the ground. When the specifications are evaluated, it becomes clear that a maximum floor height of 15 inches above the ground will be required of ATTB designs. This floor height is derived from the specifications in the Regulation, a 15 inch floor height will yield a ramp length of approximately 6 feet. According to the specifications, a 16 inch floor height will yield a ramp length of 10 feet and a 20 inch floor height, which some manufacturers seem to feel is achievable, will yield a rarnp length of 14 feet. Even with an allowable telescopic feature a 10 to 14 footramp is impractical and overly cumbersome. Therefore, 15 inches will be the maximum floor height.

A major benefit derived from a 15 inch of lower floor will be one step ingress and egress for all passengers. This feature will shorten dwell times and will afford greatly increased accessibility to persons that have difficulty negotiating stairs, mostly the elderly. A lower floor may also increase ridership among people that find the current arrangement of three steps dominating and consequently choose not to ride the bus.

❑ ATTB Design

Conceptual design of the ATTB will continue at two locations:

- The Southern California Rapid Transit District (SCRTD) is developing a conceptual design of an ATTB. The Phase I design will feature a low floor, low emissions, and light weight bus that will meet or exceed existing requirements for clean air, acccssibility, maintenance and service reliability, safety and security.
- Houston METRO is developing and demonstrating an ATTB that will feature a low floor, extra-wide doors and light weight, corrosion resistant materials. The design will make use of heavy truck components to reduce initial capital cost and maintance costs.
- A prototype of the Houston ATTB will be tested at the Bus Testing Center in Altoona, PA. Nine other ATTB' s will be constructed and evaluated in revenue service operations.

Suspended Light Rail Pilot Project

❑ Background

Monorail transportation systems actually go back to the 1800's. The first system was built in the U.S. in 1876, but they never became widely used in traditional mass transit for various reasons. However, new interest in this technology as a potential transit alternative for specialized situations prompted Congress to earmark funds for the FTA to study the potential applicability of Suspended Light Rail Transit (SLRT). SLRT combines the best features of current light rail transit with monorail technology.

Sections 26 (c) (11) of the Federal Transit Act, as amended, establishes a Suspended Light Rail (SLR) technology Pilot Project with the purpose of assessing the feasibility, cost benefits and environmental impacts of using suspended light rail systems for transporting passengers.

A Suspended Light Rail Technology Pilot Project was announced in a Federal Register Notice soliciting proposals from public agencies. Seventeen proposals for the first of three phases of the SLR pilot project were received and evaluated. The three proposals that were selected for Phase I planning studies arc: the San Francisco, CA, Bay Area Rapid Transit District; the Milwaukee County, WI, Department of Public Works and Development; and Montgomery County, MD.

❑ Applications of SLRT

Three public agencies will study the application of Suspended Light Rail Technology in site specific locations:

- The Milwaukee County (Wisconsin) Department of Public Works and Development proposes a 1.5 mile system to connect an established medical complex with satellite parking using the Aerobus system. An earlier version of the Aerobus system carried 2.5 million passengers in Mannheim, Germany.

- Montgomery County, Maryland proposes to use the Piasecki Airtrain to connect the Grosvenor Station of the Washington Metropolitan Area Transit Authority with the Montgomery Mall, via a large office park. The distance is 2.5 miles and two intermediate stops are planned. A comprehensive transportation study was completed, demonstrating the need for a transportation system.

- The San Francisco, California, Bay Area Rapid Transit District (BART) proposed to employ the American Guideway Corporation (AGC) system as a shuttle for the 3.5 miles between the Oakland Airport and the BART-Coliseum station. Two vehicles would shuttle back and forth, each on its own side of a dual guideway. The proposed system would replace an existing van shuttle service with a grade-separated non-stop fixed guideway shuttle.

Technology Development Initiatives

In order to maintain a strong, competitive transit industry and advance U.S. transportation technology and expertise, the following initiatives are underway or proposed:

- Both San Francisco' s BART and the New York City Transit Authority are undertaking major improvements to their signaling and train control systems. Both systems are using FTA technology assistance grants to design advanced train control systems capable of increasing train capacity and close train spacing with improved safety;
- New Jersey Transit is designing a system to display real-time information at commuter rail stations regarding train arrivals, delays and other relevant information;
- A Vehicle Location System is being tested to optimize automatic vehicle location methods such as track, tunnel, wayside sensors, or radio frequency links to provide greater precision of vehicle location, level of service, and emergency intervention;
- Innovative technologies used in non-transit industries, such as robotics, are being evaluated for potential use in improving maintenance efficiency in a project jointly sponsored by the Ontario Ministry of Transportation and the FTA through the Transit Development Corporation;
- Several San Francisco bay area transit agencies and the Washington Metropolitan Area Transit Authority are designing, testing, and evaluating improved mechanisms to permit unimpeded transfer by passengers between bus and rail systems;
- The Transit Research Alliance in Pittsburgh is testing the safety, economic, and environmental benefits of deploying inertial navigation tracking and control systems to determine the precise location of fixed guideway systems (moving rail and rubber tire vehicles) by sensing and interpreting the various motions of these vehicles with respect to an inertial reference frame;
- Superconducting Magnetic Energy Storage (SMES) is being evaluated by the San Francisco Bay Area Rapid Transit District as a means to overcome low voltage problems in areas where new infrastructure is not feasible;
- A Magnetic Levitation (MAGLEV) System is being analyzed for feasibility in a technology demonstration from downtown Pittsburgh to the airport.
- The New York City Transit Authority will test and evaluate a Computerized Brake Testing Dynamometer (CBTD) for determining the effectiveness of incorporating a combined brake test, front wheel alignment and suspension analysis during a scheduled preventive maintenance inspection.
- An interdisciplinary research effort will evaluate the factors that influence successful implementation of intermodal guideway public transit systems. Issues to be examined include technology options, integration of modes, measures for assessing system effectiveness, and guideway transit system competitiveness.
- Carnegie Mellon University (CMU) will assist rail transit systems in applying energy management techniques to implement one or more demonstrations of alternative energy savings methods. Emphasis will be for a transit system to demonstrate the use of alternative power sources, such as bypassing the local utility.
- Support will continue on the National Research Council' s Geo-technical Board for its information dissemination program in tunneling technology and related geotechnical research.
- Support will continue on the San Francisco BART program to redesign and replace its train control system with an advanced system capable of increasing system train capacity and reducing the distance between trains with increased safety.