Commission Briefing Paper 4J-03

Benefits and Costs of Potential Revisions to Transit Vehicle and Infrastructure Design Policies and Standards

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Date: January 10, 2007

Introduction

This paper is part of a series of briefing papers to be prepared for the National Surface Transportation Policy and Revenue Study Commission authorized in Section 1909 of SAFETEA-LU. The papers are intended to synthesize the state-of-the-practice consensus on the issues that are relevant to the Commission's charge outlined in Section 1909, and will serve as background material in developing the analyses to be presented in the final report of the Commission.

The objective of this briefing paper is to assess the benefits and costs of revisions to transit vehicle and infrastructure design standards. With SAFETEA-LU extending the current exemption from axle-weight limitations for transit buses and over-the-road buses through September 30, 2009, it is useful to examine the cost of new transit vehicle designs such as the use of composite materials, new fueling and energy storage systems, and the trend of increasing bus weight, all of which have an impact on pavement life and deterioration. Similarly, as bus rapid transit (BRT) and light rail transit (LRT) become more widely deployed, their impacts on the highway infrastructure need to be carefully examined.

Background and Key Findings

In 2004, the American Public Transportation Association (APTA) reported that Americans took 9.6 billion trips using public transportation and the growth in transit ridership has been more than 23 percent since 1995, surpassing the rate of growth in highway travel. Transit agencies in the country are progressing toward adopting new vehicle designs and materials, developing and deploying alternate- and clean-energy systems, improving transit operations and infrastructure, enhancing accessibility, and providing seamless interfaces between various modes and agencies. The following are some key findings:

- There are no official Federal transit vehicle and facility "design standards." Most transit vehicle and facility standards are industry-driven and consensus based. There are, however, regulations, such as the Federal Motor Vehicle Safety Standards (FMVSS), EPA emissions criteria, and Americans with Disability Act (ADA) accessibility regulations. The APTA "White Book" provides procurement guidelines for transit buses. APTA estimates that implementation of transit standards could result in savings of between $106 million and $264 million annually on the cost of new rail and bus vehicles. There are no design standards for rail vehicles, although there are specifications for procuring railcars.[1]

[1] Discussions with FTA staff, 12/19/2006.

- Savings associated with reductions in bus weight are fuel, infrastructure, and environmental costs. A 10 percent reduction in weight of transit buses resulting from the use of lightweight materials could increase capital cost by approximately 5 percent.[2] A FTA report also noted that reduced maintenance costs are not enough to outweigh capital costs of lightweight vehicles.[3]
- It is estimated that the total annual pavement damage to Interstate highways from transit buses is about $12 million and the total pavement damage cost to state and local roads is on the order of $1.633 billion.
- FTA reported that the number of new communities implementing bus rapid transit (BRT) service corridors is expected to grow at a rate of 4 to 6 per year in the ten-year period from 2004 to 2013.[4]
- Recent Federal Railway Administration (FRA) and Federal Transit Administration (FTA) policy statements indicate renewed interest in and support of joint use of right-of-way between FRA-compliant commuter rail and light rail transit with separate tracks or time of day separation.
- Ferry design improvements have focused on ameliorating the environmental impacts of ferry operations including reducing emissions and impact to aquatic and shoreline environments.[5]

Transit Systems Overview

Public transportation service in the United States is provided by more than 6000 agencies in different modes of transit over roadways, rail, and water. Agencies operating paratransit services and buses are the most common. Road transit includes services provided by bus, electric trolleybus, vanpool, jitney, and paratransit service. Rail modes include heavy rail, light rail, commuter rail, automated guideway transit, inclined plane, cable car, monorail, and aerial tramway. Water modes include passenger-only and vehicle ferries, and water taxis. There were 1over 143,000 active vehicles providing public transit service around the country in 2004. Buses comprise the majority of these vehicles (56.3%) and have traditionally been the mainstay of transit service in the country.[6]

Transit Buses

Several changes to transit bus design have been introduced for a variety of reasons. For example, the Federal Clean Air Act Amendments of 1990 and the Energy Policy Act of 1992, along with other state regulations, have stimulated or mandated the use of alternative fuels to power transit system bus fleets. Transit manufacturers are tasked with trying to achieve a balance between a reduction in vehicle weight and improved durability, while maintaining or increasing passenger capacity. The weight problem is compounded by the addition of heavy components associated with advanced drive technologies, alternative fuels, and passenger

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[2] *Cost-Benefit Analysis of Lighter Urban Transit Buses*. Report submitted to Transportation Development Center, Transport Canada. Prepared by Beauchemin-Beaton-Lapointe Inc. 1995.
[3] *Applicability of Maximum Axle Weight Limitations to Over-the-Road and Public Transit Buses*," Federal Transit Administration (FTA) report to Congress. December 2003.
[4] FTA, Bus Rapid Transit Vehicle Demand Analysis Update, June 2004.
[5] Ferry Transit Systems for the Twenty-First Century: A Survey of the Social, Economic, and Environmental Influences and Impacts of Ferry Systems, with Specific Illustrative Examples from the San Francisco Bay Area. Prepared by the Ad Hoc Ferry Transit Environmental Impact Panel, The Society of Naval Architects and Marine Engineers, January 10, 2000.
[6] APTA, Public Transportation Factbook, 2005.

comfort/assist devices. In an attempt to counter the trend toward heavier buses, several manufacturers are investigating advanced materials and methods for reducing vehicle weight. These efforts include the introduction of computer-designed structures that utilize advanced and composite materials.

Vehicle design policies and standards

Bus Weight Policies: An FTA report[7] examined the axle-weight distributions in a bus and the trends and costs of operating overweight buses. Bus weight has been a concern to the transit industry as well as the highway construction and maintenance community in terms of the impacts on fuel economy, operating costs, infrastructure damage, pollution costs, and noise levels. In urban areas, pavement deterioration such as rutting in bus bays and curb lanes has been identified as a high-cost maintenance problem. Transit buses have seen a substantial increase in empty weight due to several contributing factors, including the use of heavier alternative fuel systems, and the need to provide accommodation to passengers with disabilities. A report[8] examining the impacts of compressed natural gas (CNG) buses on pavement life quoted that over 90 percent of the buses have single rear axle loads greater than 20,000 lbs, which is the single axle load limit on state and interstate highways in Texas. The study further reported that Austin city transportation officials estimate that heavy buses are responsible for 70 to 90 percent of the damage to the streets on the bus routes.

A transit axle load study[9] concluded that technologies or regulatory requirements that result in a reduction in bus weight are beneficial to the pavement life, as opposed to those that increase bus weight. Reduction in pavement damaging-effects of transit bus operations particularly in curb lanes and bus bays in urban areas involves optimization of several factors including: (i) bus size, passenger capacity, and fuel capacity (ii) use of lightweight materials in the bus manufacturing industry, (iii) pavement structural design, and (iv) pavement material selection.

Lightweight Materials: In the 1990s the FTA and the Los Angeles County Metropolitan Transit Authority funded a project to develop a lightweight Advanced Technology Transit Bus (ATTB). FTA currently funds the development of light-weight, low-cost, high-performing materials for buses and other mass transit applications through the Southern Research Institute (SRI) at the University of Alabama - Birmingham (UAB). An FTA report[10] noted that buses with individual lighter-weight components could have a small positive benefit for transit and over-the-road bus fleet managers in terms of reduced operating and maintenance costs, but in many cases, this benefit is currently not enough to outweigh the difference in capital cost.[11] A Canadian study[12]

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[7] *Applicability of Maximum Axle Weight Limitations to Over-the-Road and Public Transit Buses*," Federal Transit Administration (FTA) report to Congress. December 2003..

[8] Dingyi Yang and Robert Harrison, *Impact of Compressed Natural Gas Fueled Buses on Street Pavements*, Center for Transportation Research, The University of Texas at Austin, 1995.

[9] *Transit Bus and Motor Coach Axle Weight Study*, Belanger, M., Kulakowski, B., and Fekpe, E.S. Draft Report submitted to FTA. July 2002.

[10] *Applicability of Maximum Axle Weight Limitations to Over-the-Road and Public Transit Buses*," Federal Transit Administration (FTA) report to Congress. December 2003.

[11] Applicability of Maximum Axle Weight Limitations to Over-the-Road and Public Transit Buses, Pursuant to Senate Report No. 107-38, U.S. DOT, FTA, Report to Congress. December 2003

[12] *Cost-Benefit Analysis of Lighter Urban Transit Buses*. Report submitted to Transportation Development Center, Transport Canada. Prepared by Beauchemin-Beaton-Lapointe Inc. 1995.

on lightweight materials for transit buses concluded that a 10% reduction in vehicle weight would increase the capital cost by approximately 5.5%.

Adoption of all-composite structures is slow due to concerns about cost, scarcity of domestic suppliers, and a limited track record for all-composite buses in daily operation. With the high costs of testing and development of new light-weight designs for large weight reductions[13], and in the absence of a comprehensive Federal program, incremental improvements in reducing vehicle weight, over a protracted period, maybe the best that can be expected during the current time.

However, the use of lightweight materials for buses is expected to increase in the coming years as a consequence of increasing bus weight, use of heavy alternate fuel systems, and decreasing costs of composite manufacturing. To address the cost of composite materials, specifically the cost of manufacturing carbon-fiber, FTA is currently supporting research on a pitch-based carbon fiber.

Rural and Paratransit Bus design: Transportation, especially for mobility-challenged segments, is a growing concern with questions on how to cost-effectively serve a large and dispersed population. However, due to the low market volume for small-capacity rural and paratransit vehicles, research and innovation have traditionally focused on the urban transit bus. The goal is to design a better small bus including considering alternate fuel technologies, low-floor configurations, and Intelligent Transportation Systems (ITS) technologies.

Advanced Propulsion Systems: The transit industry has been utilizing alternative fuels since early 1990 with natural gas ultimately becoming the alternative fuel of choice. The main cause for concern with the use of natural gas has been an increase in empty vehicle weight due to the weight of the CNG and the fuel tank. Since 1998, the transit industry has been working on the development of hybrid-electric advanced propulsion systems. The hybrid-electric propulsion system allows for potentially significant fuel economy increases. One of the downsides of the hybrid system is another increase in weight for energy storage (batteries) and the additional electrical components. Some optimization has been underway to reduce this weight increase; however, it is estimated that the increase in weight is 3% to 10% compared to diesel and similar to natural gas buses.[14] This is an indication that the increase in weight of natural gas buses will be continued with the next generation of transit buses with hybrid propulsion systems. More advanced fuel cell propulsion system buses are now being developed and tested. These buses are also expected to use a hybrid-electric drive system for energy efficiency. The current design of fuel cell buses appears to be 20% to 25% heavier than diesel or natural gas buses.[15]

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[13] Discussions with FTA on costs of the Transbus program in the 1970s and the ATTB program in the 1990s. Program costs are in the range of $29 million in 1971 dollars for Transbus (3 competing prototype designs) and $50 million in 1995 dollars for the ATTB, while recognizing that computerized design techniques might make the development process a bit more efficient today but the cost would have to reflect inflation.

[14] Barnitt and Chandler, *New York City Transit (NYCT) Hybrid (125 Order) and CNG Transit Buses*, National Renewable Energy Laboratory, 2006; Chandler and Walkowicz, *King county Metro Transit Hybrid Articulated Buses: Final Evaluation Results*, National Renewable Energy Laboratory, 2006.

[15] Chandler and Eudy, *Santa Clara Valley Transportation Authority and San Mateo County Transit District; Fuel Cell Transit Buses: Evaluation Results*, National Renewable Energy Laboratory, 2006.

Infrastructure and Facility Design

Changes to bus designs such as reductions in gross weight, changes in fuel storage and type, length, operating characteristics, and facility design guidelines (for bus stops and bus bays) can have wide-ranging impacts to design standards including highway pavement design and geometric design standards. Buses have been successfully using shoulders for operations during rush hours around the country. Examples include Minneapolis, Minnesota; Falls Church, Virginia; Miami, Florida; and San Diego, California; with varying designs and operations. A Transit Cooperative Research Program (TCRP) report investigating the use of shoulders for bus operations[16] identified the following concerns for infrastructure design:

- Shoulder width adequacy and lateral obstructions;
- Shoulder pavement strength;
- Signage needs;
- Modifications to drainage inlets that might compromise their function; and
- Conflicts with pavement-edge rumble strips.

Other concerns include the loss of the primary function of accommodating breakdowns or emergency operations, and narrowing of general traffic lanes. The report notes that while all the concerns are very important to facility design, they are generally addressable by physical upgrades to the highway facility. Importantly, while the costs for these upgrades vary widely, they are modest compared with most highway widening and interchange reconstruction costs for capacity increases.

In areas where buses start, stop, and turn, pavement damage is a particular concern because of the imposed load due to buses associated with these activities. The use of reinforced concrete pavement pads in these areas is intended to reduce premature pavement failures that are common with asphalt at these locations.

Bus Rapid Transit (BRT)

The objectives of BRT are focused on developing more interest in riding transit buses by making transit bus operation look and feel like light-rail operation with a high frequency of service and short headways between buses. This has included improving bus stops by adding light rail-like stations on streets, integrating ITS capabilities for travel information including arrival information and traffic signal prioritization. The buses have the appearance changed to differentiate the service from normal transit bus service, and many of the BRT systems are using buses with advanced propulsion systems (natural gas, hybrid, and potentially both).

[16] TCRP Synthesis 64, *Bus use of shoulders,* 2006.

Developing vehicle design concepts

The following are three key vehicle attributes that make BRT attractive[17]:

- Speed and Hi-Capacity – BRT vehicles are typically 40 to 60 feet long and with higher passenger capacity. Use of lightweight materials means more passengers per axle. Multiple doors and level boarding reduces boarding and dwell time.
- Distinctive Styling – The use of vehicle configurations or aesthetic enhancements to differentiate BRT from regular bus service is increasing.
- Advanced Propulsion – Lower emissions, lower operating costs, and lower noise levels are also some of the key considerations in BRT vehicle design.

In the next 10 to 15 years, BRT vehicle demand is expected to increase substantially. FTA reported that the number of new communities implementing BRT service corridors is growing at a rate of 4 to 6 per year and the quantity of BRT vehicles for those communities implementing BRT service will total 5,210 in the ten-year period from 2004 to 2013.[18] Articulated buses are the preferred vehicle type with a strong interest in incorporating advanced features into the bus design. Currently, design standards specific to BRT vehicles are not defined. However, APTA has established a BRT Vehicle Standard Working Group for standards development activities.

Infrastructure and Facility Design

BRT facility design elements include running ways, stations, fare collection systems, and ITS. Running ways are the most critical and expensive element in determining the speed and reliability of BRT services. The choice of a running way impacts the user's image and perception of the system. BRT systems in the United States have incorporated different types of running ways – mixed flow arterial (Los Angeles, Honolulu), mixed flow freeway (Phoenix), dedicated arterial lanes (Boston, Orlando), at-grade transitways (Miami), fully grade-separated surface transitways (Pittsburgh, Los Angeles), subways (Seattle, Boston), and shoulder lanes (Minneapolis/St. Paul).

With the increased planning and deployment of BRT systems, the transit industry continues to look for dedicated right-of-way, freeway shoulders, and other express lane options to increase throughput of vehicles. FTA is supporting the development of systems requirements for lane assistance systems to assist the driver in maneuvering buses under a stressful environment such as BRT operations on narrow rights-of-way.

Commuter Rail and Light Rail Transit

Rail vehicle standards and potential revisions

Rail standards development activities are undertaken through several organizations such as APTA, TCRP (Project G-4A), Association of American Railroads (AAR), and FRA. Standards have traditionally focused on safety of passengers, operations, and equipment. The recently completed Crash Energy Management (CEM) specifications have been published and made

[17] BRT Vehicle Selection Concepts for BRT Systems, Implementing a BRT Project: 2004 Bus Rapid Transit Conference, Denver Colorado May 6, 2004, Fred Silver, Vice President, WestStart.
[18] FTA, Bus Rapid Transit Vehicle Demand Analysis Update, June 2004.

available for download on APTA's website.[19] Integration of CEM in railcar design increases the safety of the vehicles by incorporating unoccupied crash zones at both ends of the vehicle. FTA research includes development of technical specifications for CEM light and heavy railcars. CEM design can minimize loss of human life during collision accidents.

Infrastructure and Facility Design

The supplement to the TCRP Report 52[20] identifies several circumstances resulting in unavailability of surplus vacant or abandoned right-of-way. The TCRP report also notes that LRT operations have been developing at an average rate of nearly two all-new systems per year over the past 20 years. The tally includes nearly 15 new LRT and 25 new Vintage Trolley systems. These initiatives use former railroad right-of-way and tracks or other rights-of-way in the areas of service. As opportunities to share rights-of-way diminish, rail transit operators and planners are re-examining the potential of sharing track. Recent FRA and FTA policy statements indicate renewed interest and support of joint-use of facilities including shared-track operations. Some major joint-use operations of rail transit and freight frequently mentioned in the literature[21] include San Diego, Baltimore, Sacramento, Salt Lake City, and New Jersey. Most of these operations involve temporal separation between the different operators (typically rail transit and freight operating at different time periods with no conflicts).

Ferry Service

In 2004, there were 47 agencies operating ferries in the U.S., providing over 68 million passenger trips. Historically, ferries have been an important mode of transit with long-standing operations in New York, the Puget Sound region, and San Francisco.[22] With the costs of building fixed guide-way infrastructure or road infrastructure skyrocketing while not appreciably decreasing commute times, there has been an increased interest in ferry service to serve shoreline populations, as appropriate. Also, in locations like San Francisco and New York, ferries are often a vital part of disaster response and recovery operations.

However, concerns have been raised about the environmental impacts of ferries, primarily concerning the high rate of emissions, and unsafe wakes and their impacts on aquatic life. In 2003, Bluewater Network[23] reported that the air emissions from three existing commuter passenger ferries in New York Harbor produce 20 to 200 times more pollution per passenger mile than other transit options, including single-occupant cars, diesel buses, and trains. Ferry vehicle design and operations have focused on reducing air pollution by incorporating new fuels such as low-sulfur diesel fuel (to reduce SOx). CNG is also promising to be a viable alternative fuel for ferries. Because of their smaller number, larger size, repetitive routes, and simpler terminal fueling facilities, ferries may prove to be better candidates for CNG fuel than bus

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[19] The website www.aptastandards.com has a listing of all published standards, including subcategories under Commuter Rail Standards Program (PRESS), Bus Transit Standards and Universal Transit Farecard Standards (UTFS) Program.

[20] Supplementing and Updating TCRP Report 52: Joint Operation of Light Rail Transit or Diesel Multiple Unit Vehicles with Railroads, TCRP Research Results Digest, Number 43, September 2001.

[21] Burke, L., Shared Use, APTS and Virtual Control: Integration and Benefits, Draft Discussion Paper for FTA, June 2000.

[22] Ferry Transit Systems For The Twenty First Century: Ad Hoc Ferry Transit Environmental Impact Panel, The Society of Naval Architects and Marine Engineers, January 10, 2000.

[23] http://www.bluewaternetwork.org/campaign_ss_ferries.shtml

fleets.[24] Ferry operations have also begun to operate as more of a transit service for daily commuters by providing real-time arrival information and other amenities such as wireless networking capabilities.

Social and Economic Issues

The infrastructure costs associated with revisions to bus design policies and standards can be assessed in terms of the upgrades to pavements, in particular, and geometry to accommodate these revisions. Pavement costs can be measured in terms of the extra damage imposed by increased axle weight due to revisions that result in increased weights. Gibby et al.[25] concluded that to increase the structural sections to accommodate bus transit, the cost of arterials would be increased by about 5 percent, while the cost of collectors would increase by 58 percent.

An FTA report to Congress[26] indicated that the potential pavement damage imposed by both transit and over-the-road buses appear to be on the same order as damage caused by trucks. However, the report indicated that since the total vehicle miles traveled (VMT) of buses is much lower than that of trucks, the total pavement damage caused by buses is at least an order of magnitude lower than that caused by trucks. The report estimated that the total annual pavement damage to Interstate highways from transit buses is estimated to cost $12 million, while the total pavement damage cost by transit buses to all other roads is much higher, on the order of $1.633 billion.

The social benefits of deploying hybrid fuel cell, hybrid electric drive systems, and other clean fuel technologies include reducing emissions and consequent threats to public health. These technologies are designed to improve air quality by striving to achieve zero-emission or near zero-emission from transit buses. Research[27] has found that even though diesel buses continue to be dominant technology, about 20% of all new bus purchases are for natural gas buses. FTA continues to sponsor research to demonstrate clean fuel technologies (including fuel-cell buses). As these technologies mature and are widely deployed, the social and economic impacts are expected to be significant. In addition to the air quality impacts of clean fuels, potential indirect benefits include increased ridership resulting in a relative reduction in single occupancy vehicle (SOV) trips and net emissions benefits to the public. Purchase of transit buses for new starts or expansion of existing service can reduce emissions by attracting commuters who normally would have driven alone and switched to transit service for their commutes. The net emissions benefit (emission reductions) of replacing SOV vehicle trips with transit buses was estimated to be about 137 kilograms per day per bus.[28]

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[24] Ferry Transit Systems for The Twenty First Century: A Survey of the Social, Economic, and Environmental Influences and Impacts of Ferry Systems, with Specific Illustrative Examples from the San Francisco Bay Area. Prepared by the Ad Hoc Ferry Transit Environmental Impact Panel, The Society of Naval Architects and Marine Engineers, January 10, 2000.

[25] *Local Urban Transit Bus Impact on Pavements*. Gibby, R., Dawson, R., Sebaaly, P. ASCE Journal of Transportation Engineering, May/June 1996, Vol. 122. No 3. pp. 215-217.

[26] U.S. DOT, FTA, Study & Report to Congress: Applicability of Maximum Axle Weight Limitations to Over-the-Road and Public Transit Buses, Pursuant to Senate Report No. 107-38, December 2003.

[27] Transit Buses – Urban Duty Cycle, Heavy Vehicles. U.S. Climate Change Technology Program – Technology Options for near and Long term. November 2003.

[28] http://www.metrocouncil.org/planning/transportation/RegSolicit/2005/Appendix.pdf

APTA estimates that implementation of transit standards could result in savings of between $106 million and $264 million annually on the cost of new rail and bus vehicles. FTA funds the development and maintenance of cost-effective transit standards among industry participants, recommended practices, and design guidelines to achieve safety, reliability, and efficiency in transit system design and operation. FTA has approved a grant for FY 2006 for $1.1 million for continued work in standards development.

Potential revisions to policy and design standards regarding BRT are intended to facilitate their operations and promote deployment by transit agencies. The potential benefits of any such revision would be increased ridership and reduced operating costs. It is the expected that in the long term, technology deployments will result in BRT operations on dedicated lanes. This will offer an attractive option to commuters, especially in the wake of increasing petroleum fuel costs and increasing congestion in urban areas. The implications are costly right-of-ways acquisition and, expensive construction costs for dedicated lanes.

With regards to commuter rail and light rail transit, the major potential revisions to the policy and design standards are directed at encouraging the joint use of right-of-ways, when the corridor has available capacity. The potential benefits of any such revision would be reduced capital costs.

Way Forward

Transit industry design standards are driven by several ongoing and anticipated challenges and opportunities that many agencies around the country face. Some of the key advances expected in the next 10 to 20 years of critical interest to public transportation in the country are summarized below.

Safety improvements of transit vehicles

Safety of vehicles continues to be a paramount concern for the transit industry. While transit is a very safe mode of travel, vehicle safety design standards are constantly being developed and deployed. Most of the rail standards development activities have focused on equipment and operations safety for commuter railroads. A major emerging area of future standardization is development of similar standards for heavy-rail and light-rail transit vehicles.[29] Similarly for buses, emerging research on the performance of buses in crashes, including energy absorption and forces transmitted to passengers and the bus operator will provide insights into the interior design of buses including seating configurations, restraints design, driver and occupant protection, etc.

New improved fuel/propulsion system

A major fuel/propulsion system breakthrough such as a significantly cheaper and/or cleaner alternative to today's commercially viable approaches (diesel, gasoline, natural gas, etc.) that can be widely applied is the goal for research, development, and demonstration of energy efficiency improvement technologies such as hybrid electric and fuel cell buses.

[29] Rail Standards Program, www.aptastandards.com

Integration of transit services

Transit in the future needs to evolve to a truly dynamic service that is seamlessly integrated across modes, services, and agencies. Complete integration of service (seamless transfers), a single payment media/mechanism and transaction, and a single, comprehensive source for customer service and information in a region would greatly enhance the transit mode share in a region. Current development activities on Universal Transit Farecard Standards (UTFS) aim to develop and implement appropriate guidelines, standards, and recommended practices to assist achieving regional standardization for transit systems, including planning, designing, procuring, and implementing revenue management programs.[30]

New paratransit/rural transit vehicle design standards

There is a need for a design standard or guidelines for rural transit vehicles.[31] So far, these vehicles tend to be modified passenger vans with reliability problems and accessibility concerns. In the next 5 years, standards and guidelines for rural transit vehicles are expected to become available to the industry and may result in demonstrations and deployments at rural transit agencies around the country.

Rail Transit Infrastructure and Operations

Rail transit infrastructure and operations have several high-priority action items for the near future that might affect design standards. The final draft of the FTA *Rail Transit ITS Research and Deployment Strategic Action Plan* - 10-Year Plan (2006 –2015)[32] listed the following five themes that future research and development efforts should focus on:

- Improved track security systems;
- Multi-modal coordination;
- Traveler advisory systems;
- Risk assessment for shared corridors; and
- Rail industry specific security issues.

References

All references are identified in the footnotes to this document.

CONSOLIDATED COMMENTS FROM MEMBERS OF THE BLUE RIBBON PANEL OF TRANSPORTATION EXPERTS - PAPER 4J-03

One reviewer commented as follows:

1. With respect to APTA commuter railcar standards, this industry-funded voluntary effort has been very successful in balancing safety with cost effectiveness. But legal issues have arisen. If the Federal Railroad Administration does not itself mandate the standards, how should commuter rail systems be treated that do not choose to

[30] Universal Transit Farecard Standards (UTFS) Program, www.aptastandards.com
[31] Advanced Small Transit Vehicle (ASTV) research, http://www.surtc.org/research/ruralbus.php
[32] FTA, Final Draft, *Rail Transit ITS Research and Deployment Strategic Action Plan* - 10-Year Plan (2006 –2015), August 2006.

participate? If FRA asks the commuter rail systems to self-evaluate their conformity, are the systems liable if there is an accident and they have previously identified a problem they are in the process of fixing?

2. Given commuter rail's operating environment (sharing tracks with freight railroads), some have argued that push-pull operations should be banned (in the "push" mode the engine is at the rear with the operator using controls in a cab-car in front). Others insist that freight and passenger trains should be required to use more expensive technology such as Positive Train Control. So far neither requirement has been mandated as cost-effectiveness has not been satisfactorily demonstrated.

3. Regarding operation of buses on shoulders of freeways, in one case a demonstration of new express bus service ultimately failed because Virginia's DOT refused for safety reasons to allow shoulder operation, even through Maryland's DOT did, on a WMATA route from Bethesda, MD to Tysons Corner, VA.

4. Uniform standards for smartcard fare collection would help many transit systems in the future, as cooperation among vendors has been very limited among those transit systems currently trying to integrate proprietary fare collection devices.