



FTA MULTI-YEAR RESEARCH PROGRAM PLAN (FY 2007 – FY 2011)

Delivering Solutions that Improve Public Transportation

FTA

Federal Transit Administration

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ACRONYMS AND ABBREVIATIONS

ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
BRT	Bus Rapid Transit
CARB	California Air Resources Board
CNG	compressed natural gas
CO	carbon monoxide
DHS	U.S. Department of Homeland Security
DMU	Diesel Multiple Unit
DOE	U.S. Department of Energy
DOJ	U.S. Department of Justice
DOT	U.S. Department of Transportation
EMU	Electric Multiple Unit
EPA	U.S. Environmental Protection Agency
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
FY	Fiscal Year
GIS	Geographic Information Systems
HC	hydrocarbon
ICE	Internal Combustion Engine
ITS	Intelligent Transportation Systems
JPO	Joint Program Office

MoU	Memorandum of Understanding
NOx	nitrogen oxides
NTD	National Transit Database
NTI	National Transit Institute
NRTP	National Research and Technology Program
OGT	Office of Grants and Training
OST	Office of Secretary of Transportation
OMB	Office of Management and Budgets
PM	particulate matter
RITA	Research and Innovative Technology Administration
ROI	return on investment
RTCC	TRB Research and Technology Coordinating Committee
SAFETEA-LU	Safe, Accountable, Flexible, and Efficient Transportation Equity Act – A Legacy for Users
TAD	FTA Office of Administration
TBP	FTA Office of Budget and Planning
TCA	FTA Office of Communications and Congressional Affairs
TCR	FTA Office of Civil Rights
TCRP	Transit Cooperative Research Program
TERM	Transit Economic Requirements Model
TOA	FTA Office of the Administrator
TOD	Transit-Oriented Development
TPE	FTA Office of Planning and Environment
TPM	FTA Office of Program Management
TRAC	Transit Research Analysis Committee
TRB	Transportation Research Board
TRI	FTA Office of Research, Demonstration, and Innovation

TRIS	Transit Research Information Service
TRO	FTA Regional Offices
TSA	Transportation Security Administration
ULSD	ultra-low sulfur diesel
UTC	University Transportation Center
UTCP	University Transportation Centers Program

EXECUTIVE SUMMARY

This Multi-Year Research Program Plan (Program Plan), prepared by the Federal Transit Administration's (FTA) Office of Research, Demonstration, and Innovation (TRI), is part of FTA's strategic planning process. It provides descriptive summaries of existing FTA research projects for Fiscal Years (FY) 2007 through FY 2011, and it links these projects to the goals and objectives of FTA's Strategic Research Plan (Strategic Plan). It also identifies future transit industry research needs, links these needs to FTA's research goals and objectives, and describes new research areas and projects that FTA will consider for funding during the next five years.

Transit research has a broad audience and diverse stakeholders each with specific interests. To be responsive to this broad and diverse community, a transit research program must address the needs of the transit industry and must positively impact transit performance. FTA's Strategic Research Plan considers the needs of the research community, and provides specific goals, objectives, and strategies for a comprehensive, national transit research program. The goals and objectives of the Strategic Plan are aligned with the U.S. Department of Transportation's (DOT's) strategic goals¹, as shown in Table ES-1.

As the office responsible for maintaining the national perspective for transit research, TRI manages and oversees FTA's transit research program, and provides industry and policy makers with the information and skills to make good business decisions about transit technology, operational, and capital investments. Although TRI is the office within FTA primarily responsible for the national transit research agenda, the research projects are managed across FTA, as well as by a variety of other organizations both within and outside of the Federal government. This Program Plan describes the variety of organizations that carry out and oversee Federally-funded transit research, including their roles, budgets, and funding.

FTA's research programs, as amended in 2005 by the *Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)*, comprise the following major programs: The National Research and Technology Program (NRTP), the National Fuel Cell Bus Technology Development Program, the Transit Cooperative Research Program (TCRP), the National Transit Institute (NTI), the Bus Testing Facility, and the University Transportation Centers Program (UTCP).

¹ Department of Transportation Draft Strategic Plan for 2006-2011

Table ES-1. FTA Strategic Research Goals and Objectives Aligned with DOT Strategic Goals

FTA Strategic Research Goals and Objectives		DOT Strategic Goals ²
Goal 1: Provide Transit Research Leadership	1.1 Ensure transit research supports national goals	Organizational Excellence – Advance the Department’s ability to manage for results and innovation.
	1.2 Continue to improve research management	
	1.3 Facilitate implementation of research results by the transit industry	
Goal 2: Increase Transit Ridership	2.1 Identify best practices and technologies to increase transit ridership	Reduce Congestion – Advance accessible, efficient, intermodal transportation for the movement of people and goods.
	2.2 Identify and overcome barriers to the adoption of ridership enhancement techniques	
	2.3 Identify solutions to provide public transportation for targeted populations	
	2.4 Identify cost-effective solutions to provide rural public transportation services	
Goal 3: Improve Capital and Operating Efficiencies	3.1 Identify practices and technologies to control capital costs	Global Connectivity – Facilitate a more efficient domestic and global transportation system that enables economic growth and development
	3.2 Identify solutions to control operating costs	
	3.3 Identify methods and technologies to improve transit operational efficiency	
	3.4 Identify solutions to improve transit infrastructure maintenance	
	3.5 Improve the capacity of the transit industry and workforce	
Goal 4: Improve Safety and Emergency Preparedness	4.1 Identify solutions to improve transit safety	Safety – Enhance public health and safety by working toward the elimination of transportation-related deaths and injuries.
	4.2 Identify solutions to reduce criminal activity	Security Preparedness and Response – Balance homeland and National security transportation requirements with the mobility needs of the Nation for personal travel and commerce.
	4.3 Identify solutions to improve transit emergency preparedness	
Goal 5: Protect the Environment and Promote Energy Independence	5.1 Facilitate development of technologies to improve energy efficiency and reduce transit vehicle emissions	Environmental Stewardship – Promote transportation solutions that enhance communities and protect the natural and built environment.
	5.2 Identify and overcome barriers to adoption of clean technologies	

Table ES-2 shows the FTA research budget for FY 2006 through FY 2009, as prescribed in SAFETEA-LU (appropriation values are for FY2006). The top part of the table lists the recipients and the authorization levels for the total authorization for the NRTP and the UTCP funded by FTA. The bottom part of the table shows the earmarks and designated funds within the NRTP authorizations that

² DOT Strategic Goals as outlined in the Draft Department of Transportation Strategic Plan for 2006-2011

reduce the amount of discretionary funds available to FTA. The balances that comprise FTA’s discretionary research funds are also shown as percentages of the total NRTP and UTCP authorization levels.

Table ES-2. The FTA Research Budget is Defined in SAFETEA-LU

FTA Research Budget in SAFETEA-LU (\$000)	FY2006	FY2007	FY2008	FY2009
National Research and Technology Programs (NRTP) (Section 5314)	\$53,658 ³	\$40,400	\$44,600	\$48,450
Transit Cooperative Research Program (Section 5313)	\$8,910	\$9,300	\$9,600	\$10,000
National Transit Institute (Section 5315)	\$4,257	\$4,300	\$4,300	\$4,300
University Transportation Centers Program (UTCP) (Section 5506)	\$6,930	\$7,000	\$7,000	\$7,000
Total	\$73,755	\$61,000	\$65,500	\$69,750
Earmarks and Designated Funds in the National Research Programs Budget (\$000)	FY2006	FY2007	FY2008	FY2009
NRTP (Section 5314)	\$53,658	\$40,400	\$44,600	\$48,450
Project ACTION	(\$2,970)	(\$3,000)	(\$3,000)	(\$3,000)
National Technical Assistance Center for Senior Transportation (Section 5314(b))	(\$990)	(\$1,000)	(\$1,000)	(\$1,000)
NRTP Earmarks (Section 3046 of SAFETEA-LU)	(\$19,389)	(\$18,855)	(\$18,225)	(\$18,615)
Appropriations Earmarks	(\$17,028)	(?)	(?)	(?)
NRTP Discretionary Research Funds	\$13,281	\$17,545	\$22,375	\$25,835
Discretionary Research Funds as percent of the FTA Research Budget (Total – NRTP and UTCP)⁴	18.0%	28.8%	34.2%	37.0%

³ Appropriators provided \$17.028 million above the SAFETEA-LU authorization level.

⁴ Appropriators included an additional \$17.028 million in earmarks in FY2006. Discretionary funds in FY2007 through FY2009 may be affected by additional earmarks in the appropriations process.

This Program Plan organizes the ongoing and potential future projects by each of the FTA strategic research goals and objectives. The description of each FTA research objective includes current research gaps and potential future research topics or projects. These topics and projects were summarized based on discussions with FTA staff and the Transit Research Analysis Committee (TRAC) conducted during this planning process, and are provided in tabular format with the following columns:

- **FTA Office** – The FTA office that manages the project.
- **Project Title and Description** – Brief descriptions of projects. Projects in italics are earmarked, or Congressionally-designated projects. Potential topics and research areas of interest to FTA under each research topic have also been identified near the bottom of the tables. Projects in red text are potential future projects
- **Funding Source** – Funding for research projects can come from different sources within the DOT.
- **Project Type** – Depending on their purpose and stage of development, FTA has categorized research projects as one of four types: *Analysis, Development, Implementation, or Training and Capacity Building*
- **Obligated Funding** – The totals in this column are indicative of funding obligated to the project in FY 2006 or prior. These are not indicative of annual funding in the FY 2007-FY 2011 time-frame. Where obligations have not been made, approved amounts are provided.
- **Project Completion Date** – Projects may have been ongoing before FY 2007 and may continue through or beyond FY 2011. Solid arrows in green in this column indicate that funds for a project are obligated and the project is ongoing. Shaded arrows (in grey) indicate that the project has no funds obligated within the time period, but is expected to start or continue in that time period. Potential future projects are in shaded cells and with red text and timelines.

The tables do not include projects that were recently closed-out or that are in the closing stages as of this document (September 2006). The tables also do not include individual projects or tasks under TCRP, UTCs or the training courses carried out by the NTI. The funding levels for these programs are provided in Appendix A.

For its FY 2006 Annual Report, the FTA will evaluate its existing research projects against its research goals and objectives. At the same time, the FTA will continue the development of a process and tools to measure its performance against defined research performance objectives and will brief or train FTA research grantees on these performance measures.

FTA will continue its research program planning and will complete the next Multi-Year Research Program Plan (FY 2008 – FY 2012) by the end of FY 2007.

FTA MULTI-YEAR RESEARCH PROGRAM PLAN (FY 2007 – FY 2011)

1.0 BACKGROUND

This Multi-Year Research Program Plan has been developed as part of the Federal Transit Administration's (FTA's) strategic planning process. This program plan includes existing FTA research projects for Fiscal Years (FY) 2007 through 2011 as well as potential further research areas and projects for funding consideration during this time frame.

FTA initiated its most recent strategic planning process by requesting that the Transportation Research Board (TRB) convene an advisory committee, the Transit Research Analysis Committee (TRAC). TRAC was charged with advising FTA as the agency develops its strategic agenda for transit research. In addition, TRAC advises FTA regarding:

1. The Federal role in transit research, relative to the roles and activities of others involved in transit research
2. High-priority opportunities proposed by the agency
3. Processes that should be in place to ensure that the FTA receives the input and cooperation of transit research stakeholders in developing the Federal research program.

TRAC was developed similar to TRB's Research and Technology Coordinating Committee (RTCC), which was convened in 1991 at the request of the Federal Highway Administration (FHWA) to provide a continuing, independent assessment of the agency's research and technology program. TRAC, like the RTCC, was convened to provide high-level, strategic guidance rather than advice on individual research projects.

TRAC met in April and December 2004, and completed their review and recommendations for FTA's Draft Strategic Research Plan in a Letter Report dated June 2, 2005. Additional TRAC meetings were held in July and August 2005 prior to the release of the final FTA Strategic Research Plan⁵ (for fiscal years 2006 through 2010) in September 2005. An additional TRAC meeting was held in December 2005 to review the final Strategic Research Plan, and a second TRAC Letter Report was completed on March 16, 2006.

The second TRAC report recommended several activities that FTA should conduct now that the Strategic Research Plan was complete and published. The recommendations included an ongoing update of the Strategic Research Plan (The Strategic Research Plan should become a living document), the creation and update of a 3- to 5-year Research Program Plan (the Multi-Year Program Plan), and specific future research needs for FTA to pursue.

⁵ FTA, September 30, 2005, Strategic Research Plan, <http://www.fta.dot.gov/documents/StrategicResearchPlan.doc>

FTA's Office of Research, Demonstration, and Innovation (TRI) completed their first Multi-Year Research Program Plan (Interim Report) in June 2006. This interim report included a summary of research projects for FY 2006 through FY 2010, and identified some high-level gaps in current research projects compared to the FTA research goals and objectives.

Immediately after completion of the interim report, TRI began work on the Multi-Year Program Plan for FY 2007 through FY 2011. This new Program Plan summarizes existing research projects and activities and identifies future transit industry research needs. Future needs were identified through discussions with FTA staff (within TRI and FTA-wide) and FTA programs (including TRB and the Transit Cooperative Research Program [TCRP], the National Transit Institute [NTI], and the TRAC).

The Program Plan was developed to link the goals and objectives of FTA's Strategic Research Plan to current and established projects, and to future research needs and potential projects. This Plan has the following sections:

- A general description of the FTA strategic framework for transit research
- A description of the organizations involved in FTA transit research including TRI, all of FTA, and other involved parties (such as those with earmarked funding for research)
- FTA's current research projects and topic areas for further research
- The path forward to the next activities in FTA's strategic research planning process.

2.0 FTA STRATEGIC RESEARCH GOALS

Transit research has a broad audience and diverse stakeholders each with specific interests. To be responsive to this broad and diverse community, a transit research program must address the needs of the transit industry and must positively impact transit performance. FTA's Strategic Research Plan considers the needs of the research community and provides specific goals objectives and strategies for a comprehensive, national transit research program. The goals and objectives of the Strategic Plan are aligned with the U.S. Department of Transportation's (DOT's) strategic goals⁶, as shown in Table 2-1. Thus, the FTA transit research program seeks a balanced portfolio of transit research to address the needs of the transit industry and to support DOT and FTA strategic goals.

Goal 1: Provide Transit Research Leadership

Transit research is carried out by a number of entities throughout the United States, including the FTA, state departments of transportation, transit agencies, universities, and other members of the transit industry. FTA alone, however, has the responsibility for addressing transit research from a national perspective. Thus, FTA must provide leadership for all transit-related research.

FTA will ensure its research programs are balanced and support national goals. As it undertakes research, FTA will first identify and analyze candidate methods and technologies for further research. These methods and technologies will be tested, or demonstrated, and evaluated. After testing, or demonstration, FTA will work to ensure that results are disseminated for implementation by the industry, including possible standards development.

Besides leading and supporting domestic research, FTA will share international best practices with the U.S. industry and will provide decision-makers with the tools and data analysis they need to make informed decisions.

Goal 2: Increase Transit Ridership

Public transportation ridership has grown by nearly 22 percent since 1995, faster than highway or air travel.⁷ APTA estimates that more than 14 million people take approximately 31 million trips each weekday. Still, transit's share of the overall "transportation market" remains small.

Increasing transit ridership is a primary goal of FTA research. While increasing the number of transit riders is important, FTA recognizes that transit ridership is a proxy for a range of societal benefits. These benefits include increasing mobility, improving access for the transit dependent, and reducing air pollution. This proxy relationship informs the aims and scope of FTA's research in

⁶ Department of Transportation Draft Strategic Plan for 2006-2011

⁷ 2005 *Public Transportation Fact Book*, APTA (2005), p. viii.

support of increasing ridership as well as developing performance measures. Increasing transit ridership also supports the DOT's new national initiative to tackle congestion⁸.

Table 2-1. FTA Strategic Research Goals and Objectives Aligned

FTA Strategic Research Goals and Objectives		DOT Strategic Goals ⁹	
Goal 1: Provide Transit Research Leadership	1.1 Ensure transit research supports national goals	Organizational Excellence – Advance the Department's ability to manage for results and innovation.	
	1.2 Continue to improve research management		
	1.3 Facilitate implementation of research results by the transit industry		
Goal 2: Increase Transit Ridership	2.1 Identify best practices and technologies to increase transit ridership	Reduce Congestion – Advance accessible, efficient, intermodal transportation for the movement of people and goods.	
	2.2 Identify and overcome barriers to the adoption of ridership enhancement techniques		
	2.3 Identify solutions to provide public transportation for targeted populations		
	2.4 Identify cost-effective solutions to provide rural public transportation services		
Goal 3: Improve Capital and Operating Efficiencies	3.1 Identify practices and technologies to control capital costs		Global Connectivity – Facilitate a more efficient domestic and global transportation system that enables economic growth and development
	3.2 Identify solutions to control operating costs		
	3.3 Identify methods and technologies to improve transit operational efficiency		
	3.4 Identify solutions to improve transit infrastructure maintenance		
	3.5 Improve the capacity of the transit industry and workforce		
Goal 4: Improve Safety and Emergency Preparedness	4.1 Identify solutions to improve transit safety	Safety – Enhance public health and safety by working toward the elimination of transportation-related deaths and injuries.	
	4.2 Identify solutions to reduce criminal activity	Security Preparedness and Response – Balance homeland and National security transportation requirements with the mobility needs of the Nation for personal travel and commerce.	
	4.3 Identify solutions to improve transit emergency preparedness		
Goal 5: Protect the Environment and Promote Energy Independence	5.1 Facilitate development of technologies to improve energy efficiency and reduce transit vehicle emissions	Environmental Stewardship – Promote transportation solutions that enhance communities and protect the natural and built environment.	
	5.2 Identify and overcome barriers to adoption of clean technologies		

⁸ DOT, National Strategy to reduce congestion on America's Transportation Network, May 2006

⁹ DOT Strategic Goals as outlined in the Department of Transportation Draft Strategic Plan for 2006-2011

Goal 3: Improve Capital and Operating Efficiencies

To help ensure that every transit project produces a good return on investment (ROI), FTA has a goal to improve capital and operating efficiencies. Reducing and controlling capital costs of both infrastructure and vehicles helps assure that projects are completed on time and within budget, and that expected ridership is achieved. Once a capital investment is in place, ROI is maximized by ensuring that operations are both cost-effective and efficient over its useful life.

Transit operations also face considerable challenges to control operating costs. Primarily due to the addition of new systems and the expansion of existing ones, operating expenses increased nearly 57 percent between 1991 and 2003 to a total of \$24.2 billion.¹⁰

Tied to reducing operating costs is improving transit operational efficiencies. One measure of efficiency, the average operating speed of all transit modes, was 19.6 miles per hour in 2000, down from 20.3 in 1997.¹¹ Another measure, miles between major system bus failures, has shown improvement, increasing by 56 percent from 2001 to 2003. The transit industry needs information to make appropriate decisions on service operations. The industry also needs support to build the professional capacity of the transit workforce and the manufacturing industry to meet these challenges.

Goal 4: Improve Safety and Emergency Preparedness

Transit is one of the safest modes of travel. The National Safety Council's 2004 "Injury Facts" reports that riding a transit bus is 79 times safer than traveling by automobile. Transit rail passengers are 42 times safer than those traveling by car.¹² However, in 2004, transit agencies reported 248 fatalities (most not to passengers) and about 18,982 injuries reported.¹³ Thus, safety remains a priority for FTA and transit operators.

Distinguishing between transit safety and transit security is important. Safety involves unintentional events such as crashes. Potential solutions include: better driver training and testing, and better vehicle and roadway/guideway design. Security involves protection against an intentional act of violence or personal harm from a criminal or terrorist act. By statute, lead responsibility for public transportation security against terrorism threats rests with the U.S. Department of Homeland Security (DHS). A Memorandum of

¹⁰ 2003 *National Transit Summaries and Trends*, p.14.

¹¹ 2002 *Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance Report to Congress*, U.S. Department of Transportation (2003), p. ES-7.

¹² *Public Transportation Fact Book*, p. xiii.

¹³ "Transit Safety and Security Statistics and Analysis Annual Report, Fatalities by Mode and Year," <http://transit-safety.volpe.dot.gov/Data/samis/default.asp?ReportID=2>

Understanding (MOU) between the DOT and the DHS describes the roles and responsibilities of the Departments.¹⁴ FTA works closely with the DHS's Transportation Security Administration (TSA) to address protection and with the DHS's Office of Grants and Training (OGT)¹⁵ to address preparedness related to terrorism threats. Other security threats, such as non-terrorist criminal acts against transit passengers, employees, or property are addressed within the FTA. In recent years, emergency preparedness for natural disasters has also become a higher priority.

Goal 5: Protect the Environment and Promote Energy Independence

Transit agencies have increasingly focused on incorporating new propulsion technologies to make their systems cleaner and more efficient and to reduce fuel consumption. This change is due in part to community pressures and, in part, to changes in emission standards by the U.S. Environmental Protection Agency (EPA) and state agencies, such as the California Air Resources Board (CARB).

A FY 2005 analysis of electric-drive technologies carried out for FTA reports that transit agencies' primary interest in cleaner fleets was driven by regulatory and political pressure to reduce emissions or to bring their region into compliance with Federal air quality standards.¹⁶ Specifically, heavy-duty transit bus engines are regulated by EPA for the following pollutants: particulate matter (PM), carbon monoxide (CO), nitrogen oxides (NOx), and hydrocarbon (HC) emissions. These standards become more stringent in 2007 and again in 2010.

Although compressed natural gas (CNG) buses helped meet many of these goals, and comprised 11 percent of the total bus fleet in 2003, many transit agencies have been reluctant to deploy CNG buses due to associated expenses and the performance of these vehicles.¹⁷ Therefore, many transit agencies are interested in finding clean alternatives to CNG, such as ultra-low sulfur diesel (ULSD) with diesel particulate filters and hybrid-electric buses. In recent years, transit bus fleet owners have shown more interest in hybrid-electric buses. Also of high interest, but expensive to date, are fuel cell propulsion buses.

¹⁴ Annex to the Memorandum of Understanding between the Department of Homeland Security and the Department of Transportation on Roles and Responsibilities concerning Public Transportation Security, September 8, 2005.

¹⁵ Formerly the Office for Domestic Preparedness

¹⁶ Callaghan, Lisa and Sheila Lynch. "Analysis Of Electric Drive Technologies For Transit Applications: Battery-Electric, Hybrid-Electric, and Fuel Cells." FTA (August 2005), pp. 7-8.

¹⁷ Ibid, p. 8.

3.0 ORGANIZATIONAL RESOURCES AND FUNDING

Multiple organizations, both within and outside the Federal government, support FTA's transit research program, including carrying out and managing FTA-funded research. These organizations include TRI, which directs FTA's research program; other FTA offices; other DOT administrative offices and agencies; University Transportation Centers (UTCs); and several non-governmental organizations and agencies. This section describes the variety of organizations that play major roles in carrying out and overseeing federally-funded transit research and discusses budgets and funding for FTA's research program.

3.1 Organizational Resources

As the office responsible for maintaining the national perspective for transit research, TRI manages and oversees FTA's transit research program and provides industry and policy makers with the information and skills to make good business decisions about transit technology, operational, and capital investments. As shown in Figure 3-1, TRI has seven administrative divisions to administer and oversee FTA's research agenda and to disseminate results and information.

Although TRI is the office within FTA primarily responsible for the national transit research agenda, the research projects are managed across FTA, as well as by a variety of other organizations both within and outside of the Federal government. Figures 3.2, and 3.3 show the organizations that have significant roles in Federally-funded transit research. The number and variety of organizations carrying out Federally-funded transit research assures a diverse program but offers several challenges to FTA leadership, especially as FTA often cannot influence many of the areas of research given congressional earmarking.

FTA's research programs, as amended by the *Safe, Accountable, Flexible, and Efficient Transportation Equity Act – A Legacy for Users* (SAFETEA-LU), comprise the following major programs: The National Research and Technology Program (NRTP), the National Fuel Cell Bus Technology Development Program, the Transit Cooperative Research Program (TCRP), the National Transit Institute (NTI), the Bus Testing Facility, and the University Transportation Centers Program (UTCP).

Within the DOT, three modal administrations are directly involved in the transit research program (see Figure 3-2). In addition to FTA, the DOT Research and Innovative Technology Administration (RITA) administers the UTCP, and the FHWA, through its Intelligent Transportation Systems (ITS) Joint Program Office (JPO), manages ITS research that benefits both the transit and highway communities. FTA manages many of these ITS projects on behalf of the JPO. FTA also receives funding from the DOT Intelligent Transportation Systems Program.

Figure 3-3 shows organizations outside of DOT that play major roles in transit research. Specific grants are authorized to support the National Transit Institute (NTI), the TCRP, Easter Seals Project ACTION, and National Center for Senior Transportation, and the Bus Research and Testing Center. In addition, the FTA supports the transit industry standards development process administered by APTA.

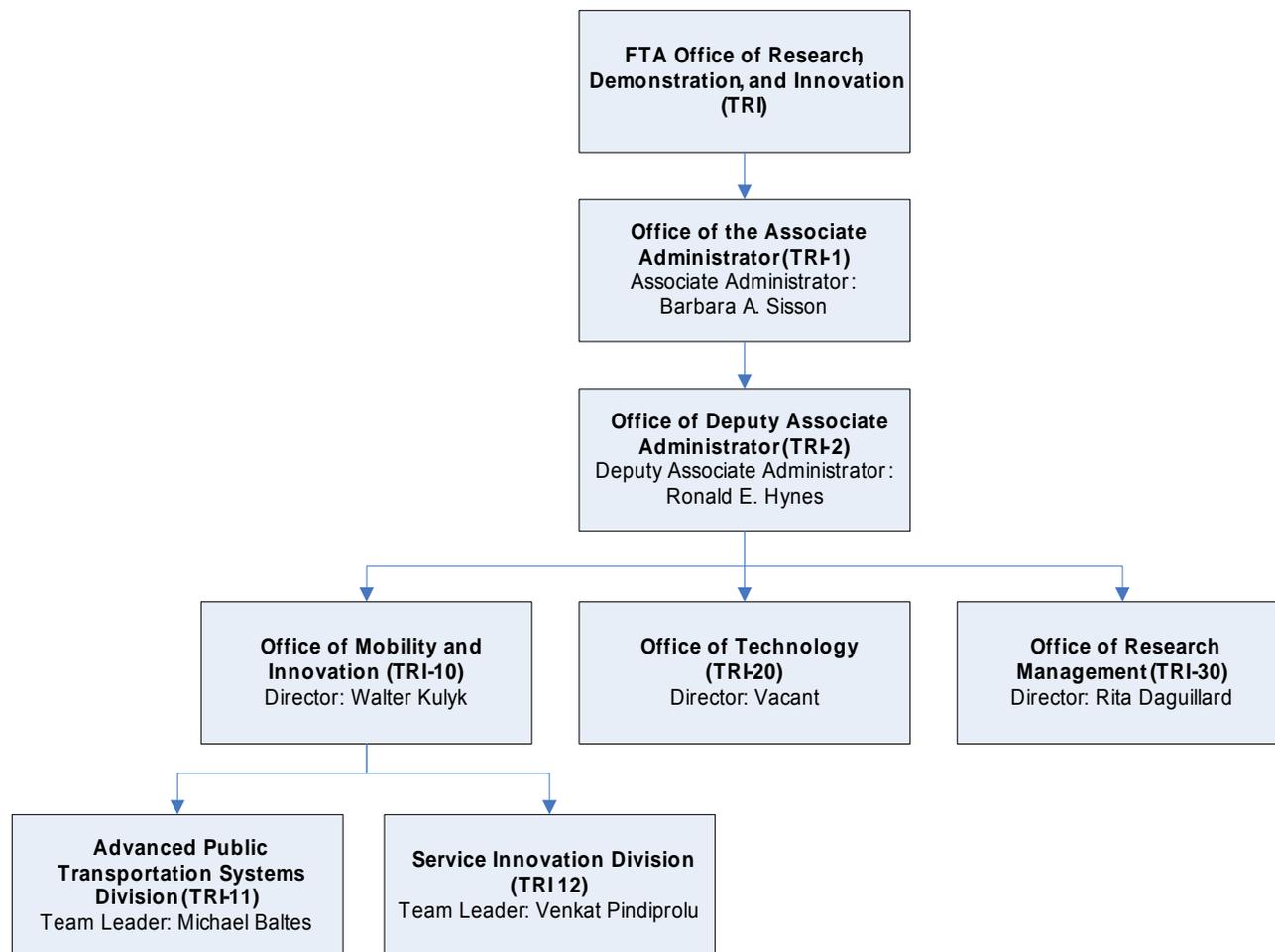


Figure 3-1. The Organization of TRI Functions to Administer and Oversee Transit Research and Disseminate Results and Information

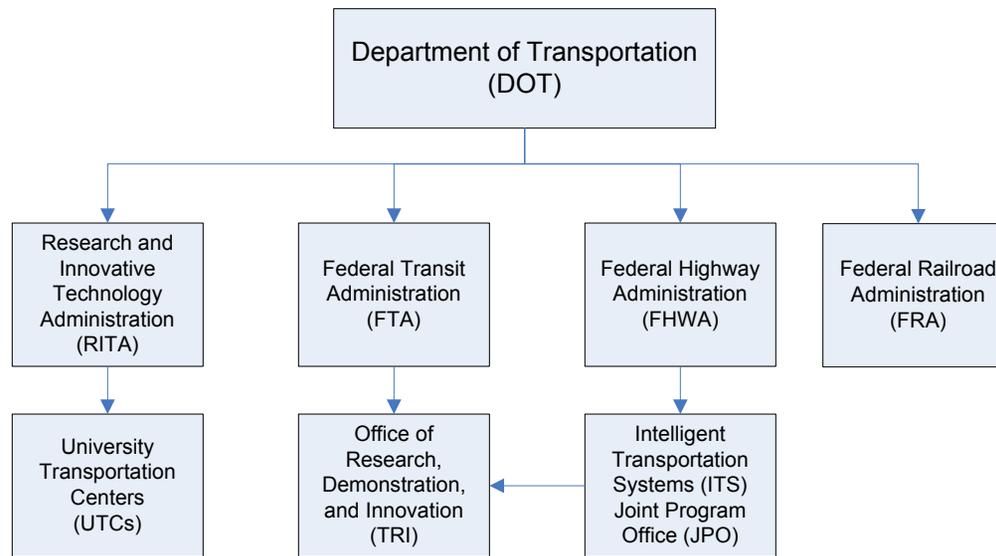


Figure 3-2. Within the Department of Transportation, RITA, FTA, FRA and FHWA are stakeholders in Transit Research.

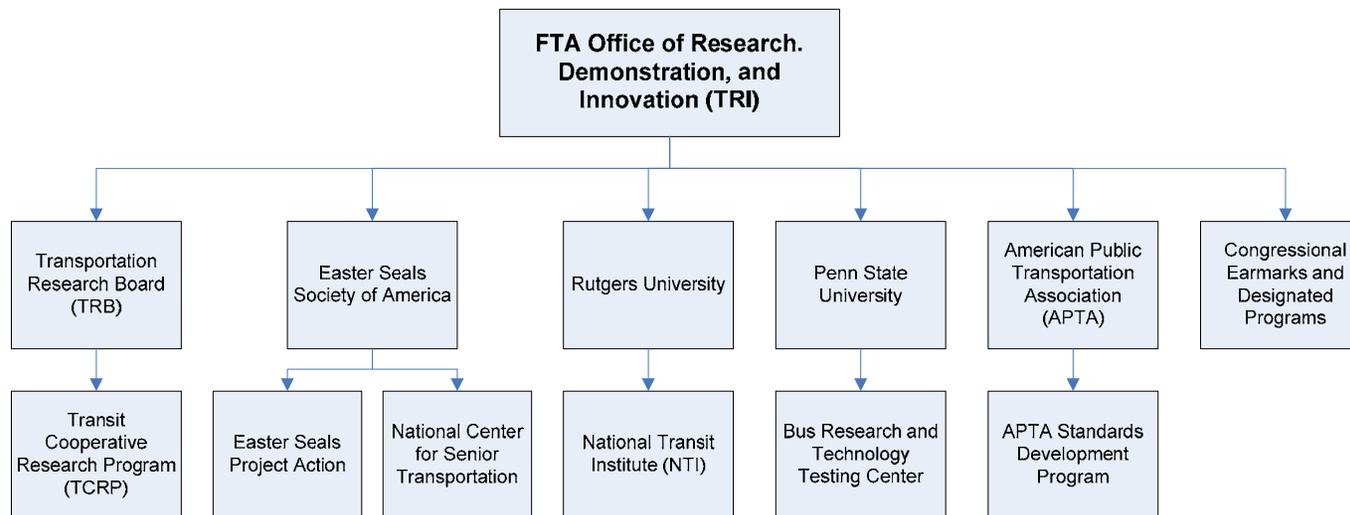


Figure 3-3. Many organizations outside of DOT participate in transit research.

3.2 Budgets and Funding

Table 3-1 shows the FTA research budget for FY 2006 through FY 2009, as prescribed in SAFETEA-LU (appropriation values are for FY 2006). The top part of the table lists the recipients and the authorization levels for the total authorization for the NRTP and the UTCP funded by FTA. The bottom part of the table shows the earmarks and designated funds within the NRTP authorizations that reduce the amount of discretionary funds available to FTA. The balances that comprise FTA's discretionary research funds are also shown as percentages of the total NRTP and UTCP authorization levels.

Although Table 3-1 shows an apparent increase in discretionary research funds from year to year, the values shown are existing authorization levels. Because budget appropriations are made annually, the actual level of earmarking or designation of funds from FY 2007 forward during the SAFETEA-LU authorization period, is unknown. Currently, FTA has discretion over only \$14 million of its \$55 million NRTP funds for FY 2006.

The current FTA research program is significantly constrained by earmarked and designated programs,¹⁸ some of which do not directly address FTA research goals and objectives as defined in the FTA Strategic Research Plan.¹⁹ The high percentage of earmarked funds makes it difficult for FTA to address any imbalances in funding to achieve its five goals by using its limited discretionary funds.

The high percentage of earmarked funds also makes it difficult for FTA to achieve a comprehensive research program within each goal. For example, in the case of goal 5, protecting the environment and promoting energy independence, almost all funding is earmarked or designated for research and demonstration projects on hybrid-electric and fuel cell buses. Further, the lack of coordination among these bus research projects makes it difficult for FTA to develop even a cohesive program of bus research and eliminate duplication or overlap of effort.²⁰ Thus, earmarks and designated funding, while they may fund useful transit research, limit FTA's ability to achieve a balanced, comprehensive, and cohesive portfolio of research to meet its strategic goals.

¹⁸ Earmarking of research funds occurs when Congress designates a research area or project, a funding amount, and a recipient organization (Brach and Wachs 2005). If a recipient organization is not specified, the term "designated", instead of "earmarked," is used.

¹⁹ About \$1.9 million (about 5 percent) of the funds earmarked from FTA's research budget are not transit related.

²⁰ Analyses show that the combined earmarks in the NRTP budget from the authorizers and appropriators in the goal 5 area total more than \$13 million. Three authorization earmarks total about \$5.8 million over the life of SAFETEA-LU. The seven appropriation earmarks for FY 2006 total \$7.4 million. Appropriators may earmark more funding in subsequent fiscal years during the SAFETEA-LU authorization period.

Table 3-1. The FTA Research Budget As Defined in SAFETEA-LU

FTA Research Budget in SAFETEA-LU (\$000)	FY2006	FY2007	FY2008	FY2009
National Research and Technology Programs (NRTP) (Section 5314)	\$53,658 ²¹	\$40,400	\$44,600	\$48,450
Transit Cooperative Research Program (Section 5313)	\$8,910	\$9,300	\$9,600	\$10,000
National Transit Institute (Section 5315)	\$4,257	\$4,300	\$4,300	\$4,300
University Transportation Centers Program (UTCP) (Section 5506)	\$6,930	\$7,000	\$7,000	\$7,000
Total	\$73,755	\$61,000	\$65,500	\$69,750
Earmarks and Designated Funds in the National Research Programs Budget (\$000)				
NRTP (Section 5314)	\$53,658	\$40,400	\$44,600	\$48,450
Project ACTION	(\$2,970)	(\$3,000)	(\$3,000)	(\$3,000)
National Technical Assistance Center for Senior Transportation (Section 5314(b))	(\$990)	(\$1,000)	(\$1,000)	(\$1,000)
NRTP Earmarks (Section 3046 of SAFETEA-LU)	(\$19,389)	(\$18,855)	(\$18,225)	(\$18,615)
Appropriations Earmarks	(\$17,028)	(?)	(?)	(?)
NRTP Discretionary Research Funds	\$13,281	\$17,545	\$22,375	\$25,835
Discretionary Research Funds as percent of the FTA Research Budget (Total – NRTP and UTCP) ²²	18.0%	28.8%	34.2%	37.0%

²¹ Appropriators provided \$17.028 million above the SAFETEA-LU authorization level.

²² Appropriators included an additional \$17.028 million in earmarks in FY 2006. Discretionary funds in FY2007 through FY2009 may be affected by additional earmarks in the appropriations process.

4.0 CURRENT AND POTENTIAL FUTURE FTA RESEARCH PROJECTS

This section is organized by FTA strategic research goals and objectives, and includes a list of active projects and potential future projects. It describes the FTA research objectives and provides individual tables of active FTA research projects for each objective. FTA project managers mapped their projects to the strategic objectives. While a project may address several objectives, it is mapped only to the primary objective to avoid duplication in the tables. The description of each FTA research objective includes research gaps and potential future research topics or projects. These topics and projects were summarized from discussions with FTA staff and TRAC conducted during this planning process.

The tables do not include projects that were recently closed-out or that are in the closing stages as of this document (September 2006). The tables also do not include individual projects or tasks under TCRP, UTCs or the training course carried out by the NTI. The funding levels for these programs are provided in Appendix A. Each of the programs has their internal mechanisms for setting a research agenda with input from the FTA. The tables contain the following information in each of the columns.

FTA Office – The FTA office that manages the project. These offices include:

- Office of Research, Demonstration, and Innovation (TRI)
- Office of Administrator (TOA)
- Office of Chief Counsel (TCC)
- Office of Communications and Congressional Affairs (TCA)
- Office of Civil Rights (TCR)
- Office of Administration (TAD)
- Office of Program Management (TPM)
- Office of Budget and Policy (TBP)
- Office of Planning and Environment (TPE)
- Regional Offices (TRO)

Project Title and Description – Brief descriptions of projects. Projects in italics are earmarked, or Congressionally-designated projects. Potential topics and research areas of interest to FTA under each research topic have also been identified near the bottom of the tables.

Funding Source – Funding for research projects can come from different sources within the DOT. These sources include:

- International Mass Transportation Program Income (International)
- National Research and Technology Program (FTA Research)
- FTA Capital Program (FTA Capital)
- FTA National Fuel Cell Bus Program
- Federal Highway Administration (FHWA)
- ITS Joint Program Office (ITS-JPO)
- FTA Oversight (Oversight)
- Transit Cooperative Research Program (TCRP)

Project Type – Depending on their purpose and stage of development, FTA has categorized research projects as one of four types:

- *Analysis* – includes basic research and analysis, planning, technical assistance, best practices, evaluation, scans, and testing
- *Development* – includes standards, specifications, guidelines, technology, hardware, software, demonstrations and infrastructure
- *Implementation* – includes the deployment and use of technology, hardware, software and infrastructure
- *Training and Capacity Building* – includes the development and delivery of training courses and human resource-related projects

In addition, certain projects are also classified as “research management” as they pertain solely to FTA management of research programs.

Obligated Funding – The totals in this column are indicative of total funding obligated to the project in FY 2006 or prior. These are not indicative of annual funding in the FY 2007-FY 2011 timeframe. Where obligations have not been made, approved amounts are provided.

Project Completion Date – Projects may have been ongoing before FY 2007 and may continue through or beyond FY 2011. Solid arrows in green in this column indicate that funds for a project are obligated and the project is ongoing. Shaded arrows (in grey) indicate that the project has no funds obligated within the time period, but is expected to start or continue in that time period. Potential future projects are in shaded cells and with red text and timelines.

Goal 1. Provide Transit Research Leadership

Objective 1.1 Ensure Transit Research Supports National Goals

Objective 1.1 addresses FTA's development of an effective and innovative approach for conducting and promoting transit research. This strategic approach, involving input from transit research stakeholders, identifies selected and high-payoff research topics and provides a starting point for identifying and filling existing research gaps. FTA has identified the following strategies under this objective:

1. Strategic planning
2. Receipt of advice on transit research from TRAC
3. Work with state DOTs, universities, and the transit industry to coordinate research efforts
4. Insurance of a balanced portfolio of research projects across FTA research programs

Table 4-1 shows current projects supporting this objective.

Current Gaps or Opportunities

The first two strategies listed above are being covered by current projects, as shown in Table 4.1. With assistance from TRAC, FTA is developing a 3- to 5- year research program plan identifying priority research topics and linking the Strategic Research Plan with FTA's annual program of research. FTA will also be evaluating the outputs of all its investments in research, including earmarked research, against the objectives of the Strategic Research Plan. While there are no projects that relate directly to the third strategy, FTA works extensively with state DOTs, universities and the transit industry and will continue to do so in the future to improve coordination. Further, the fourth strategy is partially covered in the Strategic Analysis Technical Support Project (listed in Table 4.1), but more is needed by FTA to ensure a balanced portfolio of research projects.

Potential Future Projects

The following potential future projects and topics were identified for the upcoming years:

- Update next Strategic Research Plan with more in-depth discussion of: (1) research to assist transit agencies in better preparing to respond to natural disasters; and (2) FTA's role with regard to terrorism and related research needs. (FY 08 onwards)

Objective 1.2 Continue to Improve Research Management

Objective 1.2 addresses establishing mechanisms to ensure research projects consistently produce high-quality data and deliverables and improving research administration. Improving research administration includes developing the research assessment structures needed to ensure research projects are carried out with sufficient technical rigor and that they are appropriately evaluated. FTA has identified the following strategies under this objective:

1. Monitor and implement research management best practices
2. Measure, control, and compile quality research data and deliverables
3. Develop and implement research assessment processes

There are no current FTA research projects identified under this objective.

Current Gaps or Opportunities

Even though there are currently no projects associated with the aforementioned strategies, there are internal efforts within FTA to address the strategies. For example, the second and third strategies will be addressed in part when FTA implements the performance measurement approach suggested in Section 5 of this Program Plan. Further, related to the first strategy, FTA is striving to provide more training and staff development related to managing research efforts. As such, there are ongoing internal efforts towards improving research management within FTA.

Potential Future Projects

The following potential topics were identified for the upcoming years and are mostly undertaken directly by FTA staff. Efforts include:

- Internal improvements:
 - Training for FTA program managers
 - Funding for program management when project funded outside TRI
 - More staffing resources
 - Establish and implement agency performance measurement
- Dissemination/review:
 - Hold multi-stakeholder planning session to identify products from research program
 - Annual FTA review of Strategic Research Plan in light of current events and accomplishments
 - Brief a range of stakeholders on the Strategic Research Plan

Objective 1.3 Facilitate Implementation of Research Results by the Transit Industry

Objective 1.3 establishes FTA as the source of resources to help improve transit systems. FTA plans to collect, analyze, and disseminate research data and results that the transit industry needs for decision-making. FTA also plans to help transit agencies overcome barriers to adopting new practices and technologies. FTA has identified the following strategies under this objective:

1. Identify and track domestic and international transit research
2. Ensure research results are presented in a useable format and are easily accessible
3. Identify barriers to adoption of practices or technologies

Table 4-2 shows current projects supporting this objective.

Current Gaps or Opportunities

While FTA is disseminating the results of research projects already, there are still opportunities for FTA to improve the accessibility of research material. However, FTA will be providing most research results on their website in the future. Further, there is a gap in the research program related to the third strategy, identifying barriers to adopting practices or technologies. FTA could address this strategy by including more demonstration projects that implement best practices.

Potential Future Projects

The following potential future projects and topics were identified for the upcoming years:

- Technology:
 - Demonstration program for new and innovative technologies, best practices, and systems integration. (FY 07-11)
 - Establish a “pooled” research website to coordinate research between transit agencies to share best practices (FY 07-11)
 - Technical assistance to transit agencies specifically for ITS planning, procurement and deployment (FY 07-11)
- A large of part of the following dissemination/training efforts are undertaken directly by FTA staff. Efforts include:
 - Continue to improve research dissemination and accessibility.
 - Train staff from agencies that receive earmarks to ensure effective projects and outcomes

Goal 2. Increase Ridership

Objective 2.1 Identify Best Practices and Technologies to Increase Transit Ridership

Objective 2.1 addresses gaining a better understanding of public perceptions and attitudes about transit. Research in this area examines why some individuals choose to ride transit and why others do not, and addresses how to better serve existing passengers. FTA plans to continue to examine transit operating practices to analyze how they affect ridership. Areas of research will include new forms of transit services, parking policies, fare strategies, and service redesigns to determine which have the potential to attract new and retain existing passengers. FTA has identified the following strategies under this objective:

1. Examine why individuals choose to ride or choose not to ride transit
2. Determine logical classifications of transit travel markets and identify appropriate transit services for them
3. Monitor ridership trends to identify best practices and lessons learned
4. Research and demonstrate methods to improve services for existing riders
5. Develop and experiment with pricing, parking, and yield management strategies.

Table 4-3 shows current projects supporting this objective.

Current Gaps or Opportunities

There are few projects that address the aforementioned strategies directly. The majority of existing projects only address the fourth strategy, primarily through Bus Rapid Transit (BRT) and ITS projects. Further, the existing projects focus on bus-related activities – there is only one rail-related project. There is a gap in rail-related research pertaining to ridership as well as a gap in research pertaining to understanding ridership trends and causal factors. FTA also needs to examine its role in DOT's new Congestion Relief initiative launched in May 2006. There is also a need to survey the current in-station passenger information screens in existence to test their effectiveness and try to develop an improved formalized industry standard with a focus on rail transit. FTA needs to determine what types of information screens passengers find appealing and the station locations that are most effective in disseminating information to the greatest number at the fastest rate.

Potential Future Projects

The following potential future projects and topics were identified for the upcoming years:

- Congestion relief – Examine FTA's role in DOT's congestion (FY07-09)
 - Study congestion management issues and impacts to transit,
 - Study congestion pricing and impacts on transit

- Integrated Corridor Management Systems (ICMS) – FTA Support to transit components of ICMS
- Additional rail/fixed guideway research topics and activities – to be identified (FY07-11)
- Technology/tools/analysis:
 - Improve traveler information systems (FY07-11)
 - Determine land use and community development impact on transit (FY07-09)
 - Identify needs for further research on ridership (FY 07)
 - Identify and explore opportunities to increase ridership by using high-, medium-, and lower-cost strategies (FY07-08)
- Examine Pricing, Parking, and Yield Management strategies. (FY07-09)
- In-Station Information Systems (FY 08-10)

FTA Office	Project Title and Description	Funding Source	Project Type	Obligated Funding*	Timeframe				
					Ending in FY 07 and Prior	FY 08	FY09	FY10	FY11
Intelligent Transportation Systems to increase Ridership									
TRI-11	ITS Jamestown 2007 The Virginia Department of Rail and Public Transportation, in cooperation with the Colonial National Historical Park, will develop a web-based trip planner for visitors to the Historic Triangle during the quadricentennial commemoration.	ITS-JPO	Implementation	\$50,000	▶▶▶▶				
TRI-11	Montgomery County, MD, Advanced Parking The project supports the efforts of the Montgomery County (MCDOT) to conduct a four-phase intelligent transportation systems (ITS) operational test of an advanced parking/ride share information system.	FTA Research	Development	\$333,000	▶▶▶▶				
TRI-11	Automated Passenger Information System This project will provide Miami-Dade Transit customers with an automated trip planning capability, including real-time online route and schedule information using kiosks to provide information. The kiosks will be installed at sites where pedestrian traffic is high.	ITS-JPO	Implementation	\$400,000	▶▶▶▶	▶▶▶▶			
TRI-11	Real-time Bus Arrival Information Systems Study The project will develop a set of criteria in order to evaluate what the returns on investment for real-time bus information arrival systems are.	FTA Research	Analysis	\$74,436	▶▶▶▶				
TRI-11	Door-to-Door Multimodal Trip Planning Demonstration In May 2005, the USDOT ITS Joint Program Office awarded the Regional Transportation Authority (RTA) funding to develop and demonstrate a Multimodal Trip Planner System (MMTPS). The new system will provide regional coverage throughout the six-county RTA region of Northeast Illinois.	ITS-JPO	Development	\$1,080,000	▶▶▶▶				
TRI-11	Cape Cod Transit WiFi Project The Cape Cod Regional Transit Authority (CCRTA) will design and deploy a public access node or "public hot spot" to provide advanced travel information systems (ATIS) using wireless local area network technology at the Hyannis, MA Intermodal Terminal.	ITS-JPO	Development	\$100,000	▶▶▶▶				
Non-Traditional Transit Service Delivery									
TRI-11	Vashon Island Passenger Only Ferry Study Evaluation <i>King County, WA is developing a plan for the provision of a passenger-only ferry service to Vashon Island. The study will analyze potential markets, operating and funding strategies, public and private roles, vessel type and route alternatives, and use of state-of-the art technologies for vessels and dock facilities.</i>	FTA Research	Analysis	\$100,000	▶▶▶▶				

Legend -

Projects in Italics are earmarked projects.

* - Obligated Totals represent total obligations through FY06 and are not necessarily indicative of annual funding levels in FY07-11

▶▶▶▶ - Currently obligated and ongoing

▶▶▶▶ - No funds obligated yet but expected to continue

▶▶▶▶ - Potential Future Projects are in Shaded Cells with Red Text and Timelines

FTA Office	Project Title and Description	Funding Source	Project Type	Obligated Funding*	Timeframe				
					Ending in FY 07 and Prior	FY 08	FY09	FY10	FY11
TRI-11	Vashon Island – Passenger Only Ferry Initiative <i>The project will evaluate and plan the provision of passenger-only ferry service for the general public between Vashon Island and the downtown Seattle waterfront. This project will examine the potential of using smaller, faster vessels with fuel-efficient technology to reduce operating costs and improve customer service. It is anticipated that a portion of the funds will be used to provide a service demonstration to assess the effectiveness of technology improvements and various service innovations.</i>	FTA Research	Analysis	\$868,253	▶▶▶▶				
Potential Future Projects									
TRI	Congestion relief – Examine FTA’s role in DOT’s congestion -Study congestion management issues and impacts to transit. -Study congestion pricing and impacts on transit	TBD	TBD	TBD	▶▶▶▶ ▶▶▶▶ ▶▶▶▶				
TRI	Integrated Corridor Management Systems (ICMS) – FTA support to ICMS initiative.	ITS-JPO	TBD	TBD	▶▶▶▶ ▶▶▶▶ ▶▶▶▶ ▶▶▶▶ ▶▶▶▶ ▶▶▶▶				
TRI	Additional rail/fixed guideway research topics and activities Specific research topics still to be identified	TBD	TBD	TBD	▶▶▶▶ ▶▶▶▶				
TRI	Improve traveler information systems	TBD	Development	TBD	▶▶▶▶ ▶▶▶▶ ▶▶▶▶ ▶▶▶▶ ▶▶▶▶ ▶▶▶▶				
TRI	Determine land use and community development impact on transit	TBD	Analysis	TBD	▶▶▶▶ ▶▶▶▶ ▶▶▶▶				
TRI	Identify needs for further research on ridership	TBD	Analysis	TBD	▶▶▶▶				
TRI	Identify and explore opportunities to increase ridership by using high-, medium-, and lower-cost strategies	TBD	Development	TBD	▶▶▶▶ ▶▶▶▶				
TRI	Examine Pricing, Parking and Yield Management strategies	TBD	Analysis	TBD	▶▶▶▶ ▶▶▶▶ ▶▶▶▶				
TRI	In-Station Information Systems This project would survey the current in-station passenger information screens in existence to test their effectiveness and try to develop an improved formalized industry standard. The project would also seek five rail transit agencies to deploy up to 20 improved in-station screens at each agency.	TBD	Implementation/ Analysis	TBD		▶▶▶▶ ▶▶▶▶ ▶▶▶▶ ▶▶▶▶			

Legend -
Projects in Italics are earmarked projects.
* - Obligated Totals represent total obligations through FY06 and are not necessarily indicative of annual funding levels in FY07-11
▶▶▶▶ - Currently obligated and ongoing
▶▶▶▶ - No funds obligated yet but expected to continue
▶▶▶▶ - Potential Future Projects are in Shaded Cells with Red Text and Timelines

Objective 2.2 Identify and Overcome Barriers to the Adoption of Ridership Enhancement Techniques

Objective 2.2 includes studying how ridership enhancement techniques are chosen and implemented, and what the barriers are to that implementation. Potential external factors affecting ridership can also be examined. These external factors, such as economic, employment levels, signal priorities, urban parking policies, and traffic management, are typically beyond the direct control of transit agencies. FTA has identified the following strategies under this objective:

1. Examine strategies to overcome hurdles faced by transit agencies in adopting new methods
2. Develop new forums for exchanging successful and unsuccessful experiences (lessons learned) among transit operators in their attempts to increase ridership
3. Examine external factors that affect ridership that the transit industry can influence

Table 4-4 shows current projects supporting this objective.

Current Gaps or Opportunities

The current project list does not have any projects addressing the first and third strategies of the objective. All three projects address the second strategy in part. Potential future projects need to address external factors that affect ridership that the transit industry can influence and in sharing best practices for increasing ridership.

Potential Future Projects

The following potential future projects and topics were identified for the upcoming years:

- Perception of transit:
 - Examine “Empty Bus Syndrome” (FY07-08)
- Service/service development:
 - Explore “unified or seamless” transit services delivery (FY07-09)
 - Investigating if increasing service in small urban systems (e.g., systems with 30 minute headways) would increase ridership; how to make this cost-effective (FY07-08)
 - External factors that affect ridership (FY 07)

Table 4-4. Objective 2.2 Identify and Overcome Barriers to Adoption of Ridership Enhancement Techniques

FTA Office	Project Title and Description	Funding Source	Project Type	Obligated Funding*	Timeframe				
					Ending in FY 07 and Prior	FY 08	FY09	FY10	FY11
TPE	<i>Transit Oriented Development</i> <i>The Center for Transit Oriented Development will develop standards and definitions for transit-oriented development adjacent to public transportation facilities. It will also develop system planning guidance, performance criteria, modeling techniques and provide research and technical assistance.</i>	FTA Research	Analysis	\$990,000	▶▶▶▶▶	▶▶▶▶▶	▶▶▶▶▶		
TBP	Rail~Volution-Conference (Annual) The Rail~Volution Conference is a forum for dissemination and application of knowledge about the relationship between land use and transit, including joint development and transit-oriented development.	FTA Research	Training and Capacity Building	\$15,000	▶▶▶▶▶	▶▶▶▶▶	▶▶▶▶▶	▶▶▶▶▶	▶▶▶▶▶
TBP	Congestion Initiative Expert Support This project will obtain expertise on the economics of traffic congestions, the economics of transit operations, tolling technologies, business models, public private partnerships, benefit measurement and investment finance.	FTA Research	Analysis	\$150,000 (approved) \$150,000 (obligated)	▶▶▶▶▶	▶▶▶▶▶			
TRI	Examine "Empty Bus Syndrome"	TBD	Analysis	TBD	▶▶▶▶▶	▶▶▶▶▶			
TRI	Explore "unified or seamless" transit services delivery	TBD	Analysis /Development	TBD	▶▶▶▶▶	▶▶▶▶▶	▶▶▶▶▶		
TRI	Investigating if increasing service in small urban systems (e.g., systems with 30 minute headways) would increase ridership; how to make this cost-effective	TBD	Analysis	TBD	▶▶▶▶▶	▶▶▶▶▶			
TRI	External factors that affect ridership	TBD	Analysis	TBD	▶▶▶▶▶				

Legend -

Projects in Italics are earmarked projects.

* - Obligated Totals represent total obligations through FY06 and are not necessarily indicative of annual funding levels in FY07-11

▶▶▶▶▶ - Currently obligated and ongoing

▶▶▶▶▶ - No funds obligated yet but expected to continue

▶▶▶▶▶ - Potential Future Projects are in Shaded Cells with Red Text and Timelines

Objective 2.3 Identify Solutions to Provide Public Transportation for Targeted Populations

This objective is focused on targeted populations and their diverse public transportation needs and interests. The research in this area is also focused on cost-effective methods to provide needed and desired service to these targeted populations. Another area of interest is to investigate “universal design” for both these targeted populations and mainstream service technologies. FTA has identified the following strategies under this objective:

1. Determine how to expand transit services to elderly and mobility impaired populations, with an emphasis on using existing systems
2. Research and demonstrate methods to improve coordination of human services
3. Research and demonstrate technologies to improve accessibility

Current projects supporting this objective are shown in Table 4-5.

Current Gaps or Opportunities

FTA has a large number of projects looking at all the aforementioned strategies including some major initiatives (Mobility Services for All Americans, United We Ride). However, this is an area that will continue to need further research as the mobility-impaired population grows in the future. Several opportunities exist for FTA to collaboratively work with other agencies to improve public transportation for mobility-impaired populations. FTA also continues to seek more cost-effective and efficient models for rural and paratransit services.

Potential Future Projects

The following potential future projects and topics were identified for the upcoming years:

- Develop business cases for on-demand transportation services – Identify different models of on-demand services, their cost-effectiveness and applicability to various operating and demographic conditions. (FY 07-08)
- Promoting strong partnerships between public transit and public works to improve path of travel (FY 07-08)
- Signage – Pilot programs to determine the benefits of remote infrared audible signage technology for provision of wayfinding and information to people who are visually, cognitively, or learning disabled. (FY 07-09)
- Transportation Equity Research Program - This program will conduct research and demonstration activities that focus on the impact that transportation planning, investment, and operations have on low-income and minority populations that are transit dependent. (FY 07-09)

Objective 2.4 Identify Cost-Effective Solutions to Provide Rural Public Transportation Services

This objective is focused on cost-effective transit service in rural areas. Research is needed to determine a reasonable stratification of rural transit services and logical approaches to providing transit services in rural areas with different traits and requirements. Additionally, research is needed for examining appropriate vehicles and technologies such as ITS and appropriately sized and designed buses. FTA has identified the following strategies under this objective:

1. Determine classifications of transit services in rural areas
2. Research logical approaches to transit in rural areas
3. Identify parameters for appropriate vehicles for rural use

Current projects supporting this objective are shown in Table 4-6.

Current Gaps or Opportunities

The primary gap in this objective is in the third strategy, where no projects have been identified. The first strategy is being addressed, in part, by the work done at the Small Urban and Rural Transportation Center. Most of the current projects address the second strategy. However, there are a limited number of projects that actually examine innovative service and service delivery methods for rural areas.

Potential Future Projects

The following potential future projects and topics were identified for the upcoming years:

- Examine efficiencies of demand response service in remote rural areas (FY07-08)
- Identify appropriate vehicle parameters for rural transportation (FY 07-10)

Table 4-6. Objective 2.4 Identify Cost-effective Solutions to Provide Rural Public Transportation Services

FTA Office	Project Title and Description	Funding Source	Project Type	Obligated Funding*	Timeframe				
					Ending in FY 07 and Prior	FY 08	FY09	FY10	FY11
Advanced Technologies for Rural Transit									
TRI-11	Operation test for advanced technologies This project will support efforts to increase opportunities for participation in community "whole life" activities for individuals who are historically underserved: seriously disabled, older, and other transportation dependent citizens in the Northern Shenandoah Valley.	ITS-JPO	Implementation	\$145,000	▶▶▶▶				
TRI-11	Advanced Technologies in Rural Transit This operational test will allowing operators to use transit management software via a web application to manage the transit system's daily administrative activities, schedule trips, and to use GIS-based mapping functions to route trips. Seven separate databases of customer, vehicle, driver, and operational data will be merged into a single data structure, which will be housed on an SQL server at the Eastern Carolina Council (ECC).	ITS-JPO	Implementation	\$145,000	▶▶▶▶				
TRI-11	Rural Transit ITS The Capital Area Rural Transportation System (CARTS) of Austin, TX will develop an electronic fare payment system that will coordinate human services agencies ridership and generate reports required by the Texas Department of Transportation. Additionally, CARTS will deploy a RideCARTS card for common issuance to its customers to be used in conjunction with card readers.	ITS-JPO	Implementation	\$205,000	▶▶▶▶				
TRI-11	Rural ITS Operational Test (Phase I) In the central region of Florida, there are redundant and overlapping transit operations within the Lynx and Polk County service areas. LYNX and Polk County Transit System will use advanced technologies to help synchronize feeder vans with buses, providing door-to-fixed route service and fixed route-to-door service for rural residents.	ITS-JPO	Implementation	\$197,000	▶▶▶▶				
TRI-11	Rural ITS Operational Test (Phase II) LYNX and Polk County Transit System will use advanced technologies to help synchronize feeder vans with buses, providing door-to-fixed route service and fixed route-to-door service for rural residents.	ITS-JPO	Implementation	\$150,000	▶▶▶▶				

Legend -

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FTA Office	Project Title and Description	Funding Source	Project Type	Obligated Funding*	Timeframe				
					Ending in FY 07 and Prior	FY 08	FY09	FY10	FY11
TRI-11	Lower Savannah Regional Transportation Management Model The South Carolina DOT will test the effectiveness of a regional transportation management model in coordinating and expanding transportation services in a predominantly rural area. Through this demonstration program, the Lower Savannah Council of Governments is providing leadership in the region to bring together separate public, human service and private for-profit providers of transportation services.	ITS-JPO	Implementation	\$300,000	▶▶▶▶				
TRI-11	Modoc Mobility Management Center The operational test will stimulate the efforts of the Modoc County Transportation Commission (MCTC) to initiate a Mobility Management Center in rural northeastern California that will centralize and coordinate transportation services, mobility options, eligibility screenings and information about them in a "one stop shop."	ITS-JPO	Implementation	\$120,000	▶▶▶▶				
TRI-11	Rural Wide-Area Coordinated Transit Sweetwater County Transit Authority will test and evaluate effective and efficient advanced technology methods for communications in a very large but sparsely populated area. This project will build a central communications dispatching system that is shared with other transportation services: public transit, police, fire, emergency management and ambulance services.	ITS-JPO	Implementation	\$400,000	▶▶▶▶				
TRI-12	Virtual Transit Enterprise Project <i>The objective of this agreement is to support the efforts of the South Carolina Department of Transportation (SCDOT) to design, develop, implement and demonstrate a Virtual Transit Enterprise (VTE) system that will electronically link South Carolina's public transit providers with the SCDOT.</i>	<i>FTA Capital</i>	<i>Implementation</i>	\$3,309,982	▶▶▶▶				
TRI-11	Testing of Advanced Technologies The two primary goals of this project are: 1) to demonstrate that administration of rural transit service can be enhanced through closer cooperation and coordination among state agencies and different transit systems, and 2) demonstrate that the integration of different information technology systems with existing APTS technologies will improve the delivery of rural transit services and operations.	ITS-JPO	Implementation	\$250,000	▶▶▶▶				
TRI-11	JAUNT Advanced Customer Information This project will examine systems that alert waiting passengers. This project will develop a voice-enabled interactive response system to improve customer service. The demonstration will provide customers more information on their trips and decrease the need for human intervention, while minimizing costly "no shows" for transit service.	ITS-JPO	Implementation	\$385,000	▶▶▶▶				

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Goal 3. Improve Capital and Operating Efficiencies

Objective 3.1 Identify Practices and Technologies to Control Capital Costs

This objective is focused on improving cost control of all types of transit projects and operations. Research is needed to develop and implement better ways to control costs through better design and improved methods of cost control. Transit projects include any construction of buildings and infrastructure such as guideways, tunnels, or bridges. The purchase and operation of rail and bus vehicles is also intended to be examined. FTA has identified the following strategies under this objective:

1. Improve risk management
2. Improve design and cost control methods
3. Analyze capital cost variables
4. Identify appropriate standards needs

Current projects supporting this objective are shown in Table 4-7.

Current Gaps or Opportunities

There are few projects that address the first three aforementioned strategies directly with a majority of the current projects focusing on providing project management and guidance for capital projects and new starts. Research is needed to develop and implement better ways to control costs through better design and improved methods of cost control. FTA will work closely with new project sponsors to analyze project costs, identify important capital cost variables in project design, and to use this information to help communities design and build cost-effective transit projects. FTA recognizes that any major construction project involves risk. Building tunnels, acquiring property, and navigating the unpredictable process of public involvement are all risky ventures and better methods are needed to improve risk management. The fourth strategy is being addressed by several standards-related projects, as shown in Table 4.7. However, opportunities exist in standards deployment and evaluation which are still in their infancy in the transit industry.

Potential Future Projects

The following potential future projects and topics were identified for the upcoming years:

- What is the cost of not building transit? (FY 07-08)

Table 4-7. Objective 3.1 Identify Practices and Technologies to Control Capital Costs

FTA Office	Project Title and Description	Funding Source	Project Type	Obligated Funding*	Timeframe					
					Ending in FY 07 and Prior	FY 08	FY09	FY10	FY11	
Analysis of Capital Costs										
TPM	Rail Cost Studies This project will develop tools for grantees to better estimate costs of Light Rail, Heavy Rail, and Commuter Rail projects. The project will update the 2004 Light Rail Cost Study.	FTA Research	Analysis	\$250,000 (05 approval) \$500,000 (06 approval)	▶▶▶▶▶▶▶▶▶▶					
Project Management and Guidance										
TPM	Construction Roundtable The Transit Construction Roundtable is a three-day conference held semi-annually in cities with on-going major capital projects in significant stages of construction. The meeting is facilitated by FTA and hosted by the local grantees. The participants are the chief engineers or construction chiefs of each of the top 50 transit agencies in the United States, which are implementing major transit projects.	FTA Research	Training and Capacity Building	\$18,258 (05 Obligation) \$80,000 (06 approval)	▶▶▶▶▶▶▶▶▶▶					
TRI-02	Cooperative Procurement Pilot Program Evaluations (CPPP) Section 166 of the FY 2004 Transportation, Treasury, and Independent Agencies Appropriations Act directed FTA to establish a CPPP to determine the benefits of encouraging cooperative procurement of major capital equipment. Under the CPPP, competitively selected grantees, consortiums of grantees, or members of the private sector acting as agents of grantees will develop cooperative specifications and conduct joint procurements. Pilot projects have been awarded for consortiums led by STV Incorporated for 30', 35' and 40' low-floor diesel buses; the Regional Transit Commission of Southern Nevada for 40' CNG vehicles; the Texas Department of Transportation for cutaway vehicles; and, the City of Montebello for gasoline electric hybrid vehicles. One additional consortium is still to be selected. Congress directed FTA to report on the results not later than 30 days after delivery of the base order under each of the pilot projects.	FTA Research	Analysis	\$268,434	▶▶▶▶▶					
TRI-20	National Teleconferences on Project Development Implementing new planning and environmental protection provisions of SAFETEA-LU will require outreach and discussion with MPOs and other public transportation planners. Two web-enabled teleconferences will provides cost-effective outreach to widely dispersed state and local transportation officials regarding details of new planning and environmental provisions of SAFETEA-LU. In addition, outreach on other programmatic changes such as Small Starts, Tribal Transit, and Alternative Transportation in National Parks may be included.	FTA Research	Implement-ation	\$99,410	▶▶▶▶▶					

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FTA Office	Project Title and Description	Funding Source	Project Type	Obligated Funding*	Timeframe					
					Ending in FY 07 and Prior	FY 08	FY09	FY10	FY11	
TPE	New Starts Process Review FTA will review its New Starts processes to determine areas of improvement.	FTA Research	Training and Capacity Building	\$500,000 (approved)	▶▶▶▶▶▶▶▶▶▶					
TPE	Planning Methods & Travel Demand Forecast Support & Major Investment Planning Support This program undertakes research aimed at improving the conduct of planning and development of major transit capital investments. The program allows FTA to continue to provide enhanced tools and methods for a number of technical planning activities.	FTA Research	Analysis	TBD	▶▶▶▶▶▶▶▶▶▶					
TPE	Public Transportation Participation Pilot Program <i>This program will support planning and public transportation activities related to public transportation projects, including: data collection, technical assistance, identifying innovative techniques, and enhancing coordination.</i>	FTA Research	Analysis	\$990,000 (approved)	▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶					
TPE	New Jersey Institute of Technology's Transportation, Economic, and Land Use System <i>To support further development of the New Jersey Institute of Technology's Transportation, Economic, and Land Use System (TELUS)</i>	FTA Research	Analysis	\$495,000 (approved)	▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶					
Potential Future Projects										
TBD	What is the cost of not building transit? (FY 07-08)	TBD	Analysis	TBD	▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶					

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Objective 3.2 Identify Solutions to Control Operating Costs

This objective area includes the study of controlling operating costs including alternative services; salaries, wages, and fringe benefits; vehicle operations; non-vehicle maintenance; and general administration. This research is focused on the life-cycle cost aspects of each of these categories of operating cost. FTA plans to examine innovative designs, integration, and interoperability to reduce costs (or at least manage additional operating costs). FTA has identified the following strategies under this objective:

1. Analyze alternative delivery providers
2. Examine full life-cycle costs of capital investments
3. Analyze costs of technology adoption on operations
4. Identify and analyze platforms for systems integration

Current projects supporting this objective are shown in Table 4-8.

Current Gaps or Opportunities

Projects under this objective currently pertain to bus equipment, materials, testing, and technical assistance and do not address any of the four strategies directly. As such, each of the above strategy statements represents a gap in research that FTA could undertake in the upcoming years. Further, there are no rail-related projects relating to controlling operating costs. Methods to reduce operating costs, including alternative service delivery providers and automation, life-cycle costing including the impact of capital expenditures on future operating costs as well as the operating costs of adopting new practices and technologies are areas where additional research is needed. Another area of research is to identify platforms for systems integration to ensure technologies are interoperable.

Potential Future Projects

The following potential future projects and topics were identified for the upcoming years:

- Analysis of vehicle breakdowns (FY 07-08)
- Conduct research concerning the development of key operating, performance, and financial indicators to create meaningful benchmarks for all transit properties (FY 08-09)
- Evaluate Diesel Multiple Units versus Electric Multiple Units for lifecycle costs of operations (FY 08-09)
- Cost analysis- Benchmark transit versus private sector capital costs (FY 07-08)
- Vehicle capital versus operating costs (life-cycle costs) (FY 07-08)

FTA Office	Project Title and Description	Funding Source	Project Type	Obligated Funding*	Timeframe				
					Ending in FY 07 and Prior	FY 08	FY09	FY10	FY11
TRI-10	Energy Management Study <i>The Morgantown Personal Rapid Transit System (PRT) is in need of a major overhaul of the various components of its system. This will reduce the high-energy usage and establish more efficient operations and less costly maintenance for a system that has not been updated, since it was contracted approximately 25 years ago. In Phase I, a consultant retained by West Virginia Univeristy is developing a comprehensive study on the Morgantown PRT system elements to determine which are the high-energy usage system elements. Alternative technology (new equipment) and/or optimization strategies developed in Phase I will be tested and evaluated in Phase II of the project.</i>	FTA Research	Implementation	\$971,860	▶▶▶▶				
TRI-20	Useful Life of Transit Buses and Vans The contractor will analyze and estimate effects of possible changes in FTA policies regarding bus life expectancy on the transit bus manufacturing industry, the ability of public transportation agencies to fund replacement buses, the deployment of advanced technologies that improve emissions or fuel economy, and expected ridership response if passengers can be served by newer, more attractive buses.	FTA Research	Analysis	\$299,873	▶▶▶▶				
Technical Assistance and General Research									
TRI-20	Great Cities Universities Transportation Consortium <i>The Urban Serving Universities Transportation Initiative (USU-TI) is a collaborative effort among 21 urban universities throughout the country focused on the application of new technologies to transportation problems in urban areas with specific attention to the transit field. By assessing, developing, and utilizing the latest technologies and innovations in the transit field, the USU-TI promotes more effective transit planning and more efficient utilization of federal transportation dollars.</i>	FTA Research	Analysis	\$1,995,600	▶▶▶▶				
TRI-11	Transit Operations Decision Support System Transit Operations Decision Support Systems (TODSS) are systems designed to support dispatchers and others in real-time operations management in response to incidents, special events, and other changing conditions. A joint FTA and ITS-JPO effort, the "Core Functional Requirements For Identification Of Service Disruptions And Provision Of Service Restoration Options" was completed in May 2003. However, no installed system in the country incorporates all of the TODSS Core functional requirements for either service disruption identification or provision of service restoration options. This project provides support for implementing and testing the viability of the core requirements.	ITS-JPO	Implementation	\$600,000	▶▶▶▶				
TRI	Analysis of vehicle breakdowns (FY 07-08)	TBD	Analysis	TBD	▶▶▶▶	▶▶▶▶			

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FTA Office	Project Title and Description	Funding Source	Project Type	Obligated Funding*	Timeframe				
					Ending in FY 07 and Prior	FY 08	FY09	FY10	FY11
TRI	Conduct research concerning the development of key operating, performance, and financial indicators to create meaningful benchmarks for all transit properties		Analysis	TBD		▶▶▶▶▶▶▶▶			
TRI	Evaluate Diesel Multiple Units versus Electric Multiple Units for lifecycle costs of operations (FY 08-09)	TBD	Analysis			▶▶▶▶▶▶▶▶			
TRI	Cost analysis- Benchmark transit versus private sector costs (FY 07-08)	TBD	Analysis	TBD	▶▶▶▶▶▶▶▶				
TRI	Vehicle capital versus operating costs (life-cycle costs) (FY 07-08)	TBD	Analysis	TBD	▶▶▶▶▶▶▶▶				

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Objective 3.3 Identify Methods and Technologies to Improve Transit Operational Efficiency

This objective area focuses on operational improvements in bus, heavy rail, and demand response operations. FTA plans to examine methods and technologies to improve fleet operations and mobility management, as well as ITS. Research is also planned for improving the efficiency of demand response services. FTA has identified the following strategies under this objective:

1. Research and demonstrate methods to improve bus and heavy-rail efficiency
2. Examine operational delivery strategies involving fleet operations, mobility management, and ITS
3. Analyze technologies and practices to improve demand-response service performance

Current projects supporting this objective are shown in Table 4-9.

Current Gaps or Opportunities

While there are several projects addressing methods to improve bus efficiency (i.e., BRT, transit signal priority etc), there are no similar projects in the rail area pertaining to efficiencies. Current research on operational delivery strategies focus heavily on BRT and ITS. Given that demand response services represent 20 percent of vehicle miles, but less than 1 percent of unlinked passenger trips, research is needed on improving the efficiency of demand response services.²³ While there are few projects in Table 4.9, that address that, demand-response services are directly related to Objectives 2.3 (targeted populations) and 2.4 (rural transportation). Projects in those two objectives do address operational efficiencies of demand-response services.

Potential Future Projects

The following potential future projects and topics were identified for the upcoming years:

- Technology:
 - ITS/technology return on investment (FY 08-10)
 - Human-automation interaction (FY 07-09)
 - Driverless technology (FY 09-10)
- Weather-related impacts and research needs for transit (FY 08-09)
- Organizational/Institutional:
 - Determine structure of industry in 5-10 years and where funding will be available (FY 07-08)
 - Determine ability of transit to handle impacts of gas price increases (FY 07)
 - Determine implications of commuting patterns and transit's ability to adapt to it (FY 07-08)

²³ 2003 *National Transit Summaries and Trends*. p. 11.

FTA Office	Project Title and Description	Funding Source	Project Type	Obligated Funding*	Timeframe				
					Ending in FY 07 and Prior	FY 08	FY09	FY10	FY11
TRI-11	ITS Deployment <i>The Central Ohio Transit Authority (COTA) will upgrade its radio communication system to integrate with the Franklin County Public Safety system so that its dispatchers and bus drivers can have direct communications with the county police and emergency forces. COTA also will install automated vehicle locator system on a portion of the existing transit fleet and provides real-time transit information in selected central business district bus stop locations.</i>	ITS-JPO	Implementation	\$1,577,890	▶▶▶▶				
TRI-11	Integrated Communications <i>The Greater Cleveland Regional Transit Authority (GCRTA) will design, construct and operate a Traffic Management and Integrated Communications Center to provide multi-modal transportation services. The proposed ITS components include traffic management, emergency management, transit management, and a public or private information service provider for real time traveler information.</i>	ITS-JPO	Implementation	\$791,469	▶▶▶▶				
TRI-11	ITS Pilot Project <i>In coordination with FTA, Ohio State University will organize and host a one-day technical workshop to select one or more ITS research projects that could benefit the transit industry. OSU will then submit a revised Statement of Work (SOW) and budget for the selected project(s) to the FTA for approval. The approved project(s) will be designated as the ITS Pilot Project that OSU will execute in the FY 07-09.</i>	FTA Research	Analysis	\$460,350 (06 approved)	▶▶▶▶	▶▶▶▶	▶▶▶▶	▶▶▶▶	
TRI-20	Center for Advanced Transportation Initiatives <i>To support the research efforts of the Rutgers Center for Advanced Transportation Initiatives</i>	FTA Research	Analysis	\$495,000 (06 approved)	▶▶▶▶	▶▶▶▶	▶▶▶▶	▶▶▶▶	
Potential Future Projects									
TRI	ITS/technology return on investment	TBD	Analysis	TBD		▶▶▶▶▶▶▶▶▶▶▶▶▶▶			
TRI	Human-automation interaction	TBD	Analysis	TBD	▶▶▶▶	▶▶▶▶▶▶▶▶▶▶			
TRI	Driverless technology	TBD	Analysis	TBD			▶▶▶▶▶▶▶▶▶▶		
TRI	Weather-related impacts and research needs for transit	TBD	Analysis	TBD		▶▶▶▶▶▶▶▶▶▶			
TRI	Determine structure of industry in 5-10 years and where funding will be available	TBD	Analysis	TBD	▶▶▶▶▶▶	▶▶▶▶▶▶			
TRI	Determine ability of transit to handle impacts of gas price increases	TBD	Analysis	TBD	▶▶▶▶▶▶				
TRI	Determine implications of commuting patterns and transit's ability to adapt to it	TBD	Analysis	TBD	▶▶▶▶▶▶	▶▶▶▶▶▶			

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Objective 3.4 Identify Solutions to Improve Transit Infrastructure Maintenance

This objective area focuses on FTA's plans to seek methods to facilitate and improve the monitoring and maintenance of transit infrastructure. This includes development of improved and integrated maintenance and management systems to monitor the state of defects and repairs on transit systems. Research is also planned in the area of using GIS to improve the capability of transit systems to track, analyze, and control transit assets. FTA has identified the following strategies under this objective:

1. Research improved inspection and integrated maintenance systems
2. Examine the use of GIS to track infrastructure assets

Current projects supporting this objective are shown in Table 4-10.

Current Gaps or Opportunities

FTA is currently not undertaking major activities in this area. Several promising approaches exist in improving rail and bus infrastructure maintenance. Methods to facilitate and improve the monitoring and maintenance of transit infrastructure including development of improved and integrated maintenance and management systems to monitor the state of defects and repairs on transit systems, the use of Geographic Information Systems (GIS) to improve the capability of transit systems to track, analyze, and control transit assets are just some areas where research needs to be focused. FTA has identified the need to review the types of track degradation and their impacts to rail transit operations. This project will also test technologies for monitoring and reporting the degradation. Much of the track studies have focused on impacts to rail freight operations. TCRP has developed some reports on track damage and environmental considerations. However, with ever increasing shared corridor and shared track arrangements between rail freight operations and rail transit operations, expanded and different types of impacts are now being generated. Track degradation can occur through normal wear and tear combined with inadequate maintenance or through environmental impacts such as track bed washouts and extreme temperatures. Track switching has been problematic in icy conditions, while heat speed restrictions (i.e., heat orders) issued by CSX during extreme heat conditions within its Mid-Atlantic Region has greatly impacted both freight and transit operation.²⁴

Potential Future Projects

The following potential future projects and topics were identified for the upcoming years:

²⁴ FTA, Rail Transit ITS Research and Deployment Strategic Action Plan, 10-Year Plan (2006-2015), Prepared by Volpe National Transportation Systems Center in cooperation with Rail Special Interest Group (Rail ITS SIG), APTA and ITS America, August 2006.

- Technology:
 - Automating fleet and service management information (FY 07-09)
 - Use of GIS in infrastructure asset monitoring and management (FY 07-09)
- Rail transit track degradation monitoring - This project would incorporate a white paper study that lists these types of track (and track bed) degradation, when and where these events are most likely to occur, their impacts on all transportation operating within the rail corridor (transit, freight, AMTRAK, other modes that cross or link with these systems), and technologies that could be used to monitor and warn of these conditions. This white paper would compile the information already developed and apply that information to the rail transit operations. The white paper could be used to outline and detail the next phase - a rail transit ITS deployment test for these corridors (fiber optic filament application system, continuous current recorders, on-vehicle monitoring systems, etc.) to be deployed with at least two rail transit agencies operating along shared corridors. The technologies could provide remote or on-site conditional reporting. (FY 08-11)
- Best practices of rapid repair and restoration (FY 07-09)

Table 4-10. Objective 3.4 Identify Solutions to Transit Infrastructure Maintenance

FTA Office	Project Title and Description	Funding Source	Project Type	Obligated Funding*	Timeframe				
					Ending in FY 07 and Prior	FY 08	FY09	FY10	FY11
TPM	Fixed Guideway Modernization Program Analysis Analyze the effectiveness of using Section 5309 Fixed Guideway Modernization Program (FGMP) funds to see if they are effective in the maintenance of infrastructure of fixed guideway systems. This effort would be completed in conjunction with and preparation of the annual Conditions and Performance Report.	FTA Research	Analysis	\$100,000 (05 approval)	▶▶▶▶				
TRI	Automating fleet and service management information (FY 07-09)	TBD	Development	TBD	▶▶▶▶ ▶▶▶▶ ▶▶▶▶				
TRI	Use of GIS in infrastructure asset monitoring and management (FY 07-09)	TBD	Development	TBD	▶▶▶▶ ▶▶▶▶ ▶▶▶▶				
TRI	Rail transit track degradation (FY 08-11) This project incorporates a white paper study that lists these types of track (and track bed) degradation, when and where these events are most likely to occur, their impacts on all transportation operating within the rail corridor (transit, freight, AMTRAK, other modes that cross or link with these systems), and technologies that could be used to monitor and warn of these conditions. The white paper could be used to outline and detail the next phase - a rail transit ITS deployment test for these corridors (fiber optic filament application system, continuous current recorders, on-vehicle monitoring systems, etc.) to be deployed with at least two rail transit agencies operating along shared corridors. The technologies could provide remote or on-site conditional reporting.	TBD	Development	TBD			▶▶▶▶ ▶▶▶▶ ▶▶▶▶ ▶▶▶▶		
TRI	Best practices of rapid repair and restoration (FY 07-09)	TBD	Analysis	TBD	▶▶▶▶ ▶▶▶▶ ▶▶▶▶				

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Objective 3.5 Improve the Capacity of the Transit Industry and Workforce

This objective area is focused on the improving the capacity of the transit industry, which includes the workforce and the manufacturers and suppliers. This improvement of capacity includes workforce recruitment, sharing of best practices in workforce recruitment, and a focus on developing and strengthening transit manufacturers and suppliers. FTA has identified the following strategies under this objective:

1. Promote transit workforce development best practices
2. Promote the development of the U.S. transit manufacturing industry
3. Strengthen viability of the non-rail vehicle market

Current projects supporting this objective are shown in Table 4-11.

Current Gaps or Opportunities

The National Transit Institute is the major source of training activities for transit workforce development. The international program at FTA promotes the development of the US transit manufacturing industry through trade missions, tenders listing etc. Transit agencies often cite severe problems in recruiting and retaining a skilled workforce, in part due to technology and demographic changes.²⁵ A TCRP Research Results Digest found that while a number of innovative programs exist, “the absence of mechanisms that help the industry as a whole learn from the successes of individual properties means that innovation is not shared effectively.”²⁶ Efforts focusing on filling this gap to identify and share best practices on workforce development are sorely needed.

Potential Future Projects

No potential future projects were identified in this process.

²⁵ Vogel, Brian H. “Identification of the Critical Workforce Development Issues in the Transit Industry” *TCRP Research Results Digest* Number 45 (December 2001) p.1.

²⁶ Vogel, p.3.

Goal 4. Improve Safety and Emergency Preparedness

Objective 4.1 Identify Solutions to Improve Transit Safety

This objective area is focused on collecting and analyzing transit safety data and examining potential tools for improving transit safety. One of the tools of interest is the National Transit Database (NTD), and working with State Departments of Transportation and insurance providers to identify risk factors that are causing transit incidents to determine which areas require the most focus. Potential areas to improve transit safety include improving grade crossing safety, reducing trespassing, improving vehicle crashworthiness design, and developing collision avoidance systems. FTA is also interested in identifying potential barriers to the adoption of new technologies and strategies for improving transit safety. FTA has identified the following strategies under this objective:

1. Improve grade crossing safety
2. Improve vehicle crash worthiness and occupant protection
3. Develop collision avoidance and warning systems
4. Identify barriers to the adoption of safety technologies

Current projects supporting this objective are shown in Table 4-12.

Current Gaps or Opportunities

Transit is one of the safest modes of transportation in the United States. However, given the number of fatalities and injuries reported on public transportation, solutions to improve transit safety are still needed. Currently, there are no projects related to the first strategy listed above. The FTA Rail Transit ITS Research and Deployment Strategic Action Plan²⁷ recommended grade crossing surveillance cameras as one of the high priority rail ITS projects. Such a project would explore the placement of cameras at grade crossings between rail transit and other modes. This would include crossings with pedestrian and bicycle paths, roadways, and other rail operations and test the effectiveness of cameras deployed at varied locations around the grade crossing to understand the best camera angles and locations, as well as located at varied types of crossings (2-lanes or 4-lanes roadway crossings, single or multi-track crossings, pedestrian or bike path crossings).

In the second strategy there is a significant gap since there is only one project (Crashworthiness of Transit Buses) that addresses the strategy. Further, there are no projects in the rail area for this strategy. Rail transit also faces some unique problems pertaining to

²⁷ FTA, Rail Transit ITS Research and Deployment Strategic Action Plan, 10-Year Plan (2006-2015), Prepared by Volpe National Transportation Systems Center in cooperation with Rail Special Interest Group (Rail ITS SIG), APTA and ITS America, August 2006.

safety, which are outside FRA's purview, which traditionally focused on commuter and freight rail safety research. Some areas for consideration include – Track standards for Light Rail, Crash Energy Management (CEM) for Light Rail vehicles, and Advanced Signal and Track Control Systems. FTA needs to develop an applied research program for transit rail safety with a focus on commercialization. The program should be geared to show deployed results similar to the CEM test bed for Commuter Rail which resulted in a design specification.

The third strategy is covered by several projects such as the Integrated Collision Warning System, and the Intelligent Vehicle Based Safety Systems (IVBSS), which are funded through the ITS JPO. The fourth strategy, pertaining to identifying and overcoming barriers is fairly well covered by existing projects.

Potential Future Projects

The following potential future projects and topics were identified for the upcoming years:

- Assessment of impacts of ITS on safety (FY 07-09)
- Integrated Vehicle Based Safety Systems (FY 07-09)
- Seating arrangements versus accident injury analysis (FY08-10)
- Grade Crossing Surveillance Cameras (FY 07-09)

Objective 4.2 Identify Solutions to Reduce Criminal Activity

This objective area is focused on security practices and technology for vehicles (bus and rail) and stations, transit centers, and transit facilities. The topic of fare evasion is also included in this objective area. FTA has identified the following strategies under this objective:

1. Improve onboard bus and rail security
2. Improve bus and rail station security
3. Analyze and demonstrate methods to reduce fare evasion

While there are no current projects funded, this objective is strongly linked to the next objective relating to emergency preparedness and security. Some of the gaps in this objective may be covered through projects in objective 4.3.

Current Gaps or Opportunities

Since the majority of security incidents for bus transit, 76 percent, occurred onboard buses, security efforts need to focus on making vehicles more secure. By contrast, most rail incidents occurred at stations, so research efforts need to focus on improving station safety. Developing methods to reduce fare evasion should also reduce crime as it is the most common security problem reported, comprising about 37 percent of all security incidents, followed by disorderly conduct at 25 percent.²⁸ The FTA Rail Transit ITS Research and Deployment Strategic Action Plan also recommends research on the deployment of intrusion alarms at entry points and at rail yards as high priority rail ITS projects.

Potential Future Projects

The following potential future projects and topics were identified for the upcoming years:

- Evaluation of security technologies and control systems (FY 08-10)
- Collect transit industry and international best practices for security in transit operations including the topic of fare evasion (FY07-10)
- Intrusion alarms at entry points (FY 07-08)
- Improved security package for rail transit yards (FY 09-11)

²⁸ 2005 *Public Transportation Fact Book*. p. 30.

Objective 4.3 Identify Solutions to Improve Transit Emergency Preparedness

This objective area is focused on integration of security throughout every aspect of transit programs, operations, and infrastructure. Public transportation also plays a critical role in evaluations. FTA has identified the following strategies under this objective:

1. Improve security training for all transit employees and supervisors
2. Improve emergency preparedness
3. Increase public awareness of security issues

Current projects supporting this objective are shown in Table 4-14.

Current Gaps or Opportunities

FTA has funded several earmarked projects which provide security training, and emergency preparedness technical assistance to transit agencies. Through earmarks, FTA is sponsoring on-going course training and pilot courses for first responders, emergency services and allied health professionals to meet these needs. The *FTA Rail Transit ITS Research and Deployment Strategic Action Plan* has identified research on improving radio communications between rail transit workers and public safety personnel as one of the high priority rail ITS projects with overwhelming support from rail transit representatives. Such a project would focus on enhanced radio communications between transit agencies and public safety personnel. It would investigate current communications between rail transit agencies and emergency personnel and define goals for improvement, including how to increase frequency availability. Prototype communications systems that would meet these goals would be designed, deployed, and tested at two rail transit agencies. Also, another gap in the current research projects list relates to increasing public awareness of transit security issues. The *FTA Rail Transit ITS Research and Deployment Strategic Action Plan* also recommends study of the public address systems in stations and how they can be appropriately used to convey information. Another high-priority study recommended in the same report relates to the use of rail transit in specialized evacuations during planned and unplanned events.

Potential Future Projects

The following potential future projects and topics were identified for the upcoming years:

- Best practices for system recovery (FY07-08)
- Improved radio communications between transit workers and public safety personnel (FY 07-08).
- Public address systems at transit stations (FY 09-10)
- Use of rail transit for specialized evacuations during planned and unplanned events. (FY 09-11)

FTA Office	Project Title and Description	Funding Source	Project Type	Obligated Funding*	Timeframe				
					Ending in FY 07 and Prior	FY 08	FY09	FY10	FY11
TPM	Continuity of Operations Planning This project will ensure the continuity of operations within the transit agency and FTA in the event of a terrorist attack or emergency. It is essential that major functions continue operating to protect the safety of the riding public. A practical COOP is one that ensures that communications are maintained for the transit industry in the event of a terrorist event. The maintenance funds from this project will provide funding necessary to maintain a viable COOP, as well as resources and training for personnel.	FTA Research	Analysis	\$31,000 (05 obligation) \$50,000 (06 approval)	▶▶▶▶▶				
TPE	Hurricane KATRINA Support Ensures FTA is able to provide contractual support for planning, engineering, and other technical assistance activities to state and local transportation agencies in preparation for and in response to natural and man-made emergencies and disasters.	FTA Research	Training and Capacity Building	\$720,000 (approved)	▶▶▶▶▶	▶▶▶▶▶			
TPM	Connecting Communities: These forums assist transit systems in their efforts to better plan and prepare for a variety of both system-based and community or region based incidents, following the framework of the National Incident Management System (NIMS) models.	FTA Research	Training and Capacity Building	\$200,000 (approved)	▶▶▶▶▶	▶▶▶▶▶	▶▶▶▶▶	▶▶▶▶▶	▶▶▶▶▶
TRI-20	Public Transportation National Security Study <i>The National Academy of Sciences will conduct a study and evaluation of the value major public transportation systems provide to the Nation's security and the ability of such systems to accommodate the evacuation from critical locations in times of emergency.</i>	FTA Research	Analysis	\$247,000	▶▶▶▶▶	▶▶▶▶▶			
TPM	Chemical Agent Sensor Detection Systems Evaluation	FTA Research	Analysis	TBD	▶▶▶▶▶				
TPM	National Bio-Terrorism Civilian Medical Response Center <i>This project will support the continuing efforts of the Drexel University's National Bioterrorism Civilian Medical Emergency Response Center (CIMERC) to develop enabling technologies for detection systems aimed at emergency response and preparedness to possible attacks involving biological agents released in transit environments. The prototype for this project is based on the device developed in an earlier project to modify two piezoelectric biosensor platforms (the Piezoelectric Bulk Acoustic Wave Biosensors and the Piezoelectric Cantilever Biosensor). Objectives are to modify two piezoelectric biosensor platforms (the Piezoelectric Bulk Acoustic Wave Biosensors [PPB] and the Piezoelectric Cantilever Biosensor [PCB] developed to detect anthrax. This system is designed to use plasma technology to eliminate potentially infectious organisms from the air.</i>	FTA Research	Development	\$4,171,725	▶▶▶▶▶	▶▶▶▶▶	▶▶▶▶▶	▶▶▶▶▶	▶▶▶▶▶
TRI-20	Best practices for system recovery	TBD	Analysis	TBD	▶▶▶▶▶	▶▶▶▶▶			

Legend -

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▶▶▶▶▶ - Currently obligated and ongoing

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Goal 5. Protect the Environment and Promote Energy Independence

Objective 5.1 Facilitate Development of Technologies to Improve Energy Efficiency and Reduce Transit Vehicle Emissions

This objective area is focused on continuing research, development, and demonstration of energy efficiency improvement technologies such as hybrid electric and fuel cell buses. Additional topics to reduce vehicle weight, power to accelerate, and overcome rolling resistance are included. FTA intends to seek partnerships with other parts of the Federal government, specifically the U.S. Department of Energy (DOE), to ensure that the needs of transit are kept in mind as new systems are developed, and to ensure that transit is able to implement these technologies (electric propulsion related including hybrid and fuel cell) and systems once they are commercially available. FTA has identified the following strategies under this objective:

1. Improve energy storage systems
2. Develop more advanced electric drive technologies
3. Evaluate fuel cell deployment results

Current projects supporting this objective are shown in Table 4-15.

Current Gaps or Opportunities

FTA has an extensive list of projects addressing most of the aforementioned strategies. Over the last decade, the FTA has undertaken a number of research projects that demonstrate clean vehicle technologies, including fuel-cell buses, many of them Congressionally directed. However, demonstrations of these fuel cell buses are only the first steps to the commercialization of fuel cell buses, as their cost, performance, reliability and durability currently do not meet the needs of transit operators as they are not yet affordable for revenue service and are still a major topic of research. Also, other agencies, especially the Department of Energy (DOE) have a much larger role and significantly more resources to advance the basic science of these technologies. The Energy Policy Act of 2005 will provide significant resources for DOE to lead hydrogen and fuel cell development as well as a program to carry out fuel cell transit bus demonstrations. Partnership with these agencies to ensure the needs of transit are kept in mind as new systems are developed, and to ensure that transit is able to implement these technologies and systems once they are commercially available is critical. With, nearly all of the projects in this category being earmarked projects, FTA has a challenging task of ensuring that these projects are part of a cohesive approach to improve energy efficiency.

Potential Future Projects

The following potential future projects and topics were identified for the upcoming years:

- Reducing/managing auxiliary loads on buses; electrifying auxiliary loads for hybrid and fuel cell buses

FTA Office	Project Title and Description	Funding Source	Project Type	Obligated Funding*	Timeframe				
					Ending in FY 07 and Prior	FY 08	FY09	FY10	FY11
TRI-12	San Francisco Muni Alternate Fuels New Technology Consortium <i>The San Francisco Municipal Transportation Agency (Muni) intends to be a zero emission transportation agency by the year 2020 by operating electric propulsion technology buses continuously for 18 to 20 hours per day. The objective of this project is to determine if battery-powered buses, or diesel-electric hybrid powered buses, can successfully replace diesel buses in an urban transit environment.</i>	OST	Development	\$497,050	▶▶▶▶▶▶▶▶▶▶	▶▶▶▶▶▶▶▶▶▶			
TRI-12	SunLine Transit <i>This agreement supports 13-month demonstration of the Ballard fuel cell ZeBus at SunLine Transit and the development a basic training manual for technicians.</i>	FTA Capital	Implementation	\$1,988,492	▶▶▶▶▶▶▶▶▶▶				
TRI-12	Fuel Cell Bus Training Program & Technical Support <i>The Volpe Center is supporting FTA on critical technical issues related to successfully developing a training program for fuel cell buses.</i>	FTA Capital	Training and Capacity Building	\$500,000	▶▶▶▶▶▶▶▶▶▶				
TRI-12	Transportation Fuel Cell Research <i>Northern Illinois University (NIU) in collaboration with the Argonne National Laboratory (ANL) will conduct comprehensive research to further advance fuel cell technology and to develop educational/awareness programs for preparing a skilled workforce to meet the demands of this emerging technology. This effort focuses on the development of improved, less expensive materials (electrolytes, fuel and air electro catalysts and electrodes, and interconnect/bipolar plates), as well as balance-of-plants components for fuel, air, heat, and water management at the scales needed in automotive and other applications.</i>	OST	Development	\$1,489,575	▶▶▶▶▶▶▶▶▶▶	▶▶▶▶▶▶▶▶▶▶			
TRI-12	Clean Mobility and Transit Enhancement <i>This project encourages the development and utilization of advanced transportation technologies in partnership with transit agencies. It focuses on three primary projects: 1) Innovative Clean Mobility; 2) Fuel Cell and Hydrogen Bus Technology Facilitation; and, 3) Advanced Transportation Technology Industry Support.</i>	FTA Research	Development	\$1,987,000	▶▶▶▶▶▶▶▶▶▶	▶▶▶▶▶▶▶▶▶▶	▶▶▶▶▶▶▶▶▶▶		
TRI-12	Advanced Transit Technology <i>The objective of this cooperative agreement is to support the efforts of WestStart-CALSTART to conduct a variety of Clean Fuels, Clean Propulsion Systems and Transit Enhancement projects focused on Bus Rapid Transit, Hydrogen and Fuel Cell Bus, Transit Linked Mobility and First Mile Solutions, Advanced Technology Fuels, and Advanced Transportation Technologies Industry Support.</i>	FTA Research	Development	\$1,932,416	▶▶▶▶▶▶▶▶▶▶	▶▶▶▶▶▶▶▶▶▶	▶▶▶▶▶▶▶▶▶▶		

Legend -

Projects in Italics are earmarked projects.

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FTA Office	Project Title and Description	Funding Source	Project Type	Obligated Funding*	Timeframe				
					Ending in FY 07 and Prior	FY 08	FY09	FY10	FY11
TRI-20	Fischer-Tropsch Diesel Fuel Transit Demonstration <i>The goal of this project is to demonstrate the operating performance/benefits of Fischer-Tropsch synthetic diesel fuel in transit fleet applications. The project will test Fischer-Tropsch fuel in Fairbanks, Alaska. Another demonstration (OK-26-7005) is being undertaken in Tulsa, Oklahoma, in order to cover a wide range of climates and potential operating conditions. The project will compile emissions testing data of Fischer-Tropsch diesel fuel tested to date, and evaluate the benefit of emissions reductions relative to standard diesel fuel.</i>	FTA Research	Development	\$777,486	▶▶▶▶				
TRI-20	Fischer-Tropsch clean diesel research <i>The goal of this project is to demonstrate the operating performance/benefits of Fischer-Tropsch synthetic diesel fuel in transit fleet applications. The project will test Fischer-Tropsch fuel in Tulsa, Oklahoma. Another demonstration (AK-26-7005) is being undertaken in Fairbanks, Alaska in order to cover a wide range of climates and potential operating conditions. The goal of this project is to demonstrate the operating performance/benefits of Fischer-Tropsch synthetic diesel fuel in transit fleet applications. Phase II of this project will extend the demonstration of Fischer-Tropsch fuel in Tulsa, Oklahoma (OK-26-7005) in order to obtain meaningful data on long-term fuel-compatibility in a real-world transit fleet and concurrently follow-up on relevant technical issues from phase I.</i>	FTA Research	Development	\$1,839,532	▶▶▶▶				
TRI-12	PVTA Electric Bus (Nickel - Hydrogen Battery) <i>The project supports the efforts of PVTA for the research, development and demonstration of an innovative, segmented nickel – hydrogen battery for hybrid electric transit bus applications. This effort addresses a critical deficiency of current hybrid electric bus application —the lack of a compact, inexpensive, lightweight, and durable energy storage system. The current energy storage systems for hybrid electric buses rely on battery technologies that have poor energy densities, charge acceptance, reliability and durability.</i>	FTA Research	Development	\$397,669	▶▶▶▶				
TRI-12	Electric Vehicle Transit Demonstration <i>EVERmont is a consortium consisting of the Vermont Agency of Natural Resources, Norwich University, the Vermont Agency of Transportation, Vermont Department of Public Services, Solectria, and Electric Power Research Institute. EVERmont plans to fabricate three battery electric vehicles (BEV) and modify a hybrid electric vehicle (HEV) [so that it has plug-in (PI) capability and becomes a plug-in hybrid electric vehicle (PIHEV)]. Then, it plans to perform shake-down testing of all four vehicles, and deploy all four vehicles as station cars (in New York City)</i>	FTA Research	Development	\$498,900	▶▶▶▶				

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FTA Office	Project Title and Description	Funding Source	Project Type	Obligated Funding*	Timeframe				
					Ending in FY 07 and Prior	FY 08	FY09	FY10	FY11
Potential Future Projects									
<i>TBD</i>	Reducing/managing auxiliary loads on buses; electrifying auxiliary loads for hybrid and fuel cell buses	<i>FTA Research</i>	<i>Development</i>	<i>TBD</i>	▶▶▶▶	▶▶▶▶	▶▶▶▶	▶▶▶▶	▶▶▶▶

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Objective 5.2 Identify and Overcome Barriers to Adoption of Clean Technologies

This objective area is focused on the issues of reducing costs of adopting clean technologies such as hybrid electric (initial cost of the bus), alternative fuels (such as natural gas and the infrastructure costs), and fuel cells (purchase costs of buses and infrastructure). Other issues of interest include implementation costs and ongoing operating cost increases for adopting these clean technologies. Under this objective area, FTA is focused also on providing technology, demonstration, and evaluation information needed for transit agencies to make investment decisions for these technologies. FTA has identified the following strategies under this objective:

1. Provide transit agencies with up-to-date information on clean fuel technologies
2. Develop methods to improve reliability, maintainability and performance of clean fuel technologies

Current projects supporting this objective are shown in Table 4-16.

Current Gaps or Opportunities

Transit agencies around the country have already begun the process of deploying clean fuel technologies as they have become available and affordable, with funds from FTA's Bus and Bus Facility Program. The percentage of bus fleets nationwide using alternative fuels increased from 1.2 percent in 1992 to 11.4 percent in 2003, with most using CNG.²⁹ FTA currently provides transit agencies and policy makers with the information they need to make appropriate investment decisions on these technologies. As these technologies become more widely used, understanding of the lifecycle costs of these technologies becomes critical. The other big gap under this objective is to ensure that all the ongoing development projects are part of a strategy and not isolated deployments. FTA needs to be a leader in bringing together stakeholders (developers, transit agencies) from various earmarks together. While such efforts are already ongoing (Fuel cell working groups etc), more coordination is desirable.

Potential Future Projects

The following potential future projects and topics were identified for the upcoming years:

- Capital versus operations cost analysis for clean technologies(i.e., life-cycle cost) (FY07-08)
- Electric Drive Stakeholder Workshop-Bring together stakeholders and the many and diverse earmark recipients working on electric drive technologies to develop a strategy to minimize duplication and focus efforts on achieving national goals (FY 07)

²⁹ 2003 National Transit Summaries and Trends. p. 41.

Unaligned Projects

In the process of organizing FTA's current set of research projects into the FTA research goals and objectives, there were several projects that did not fit into that framework. These projects are presented in Table 4-17. The term "unaligned projects" does not necessarily imply that there are no useful projects under this category, rather the projects do not fit neatly into any of the goals or objectives specified in the strategic plan.

Table 4-17. Unaligned Projects – None of the Objectives Apply

FTA Office	Project Title and Description	Funding Source	Project Type	Obligated Funding*	Timeframe				
					Ending in FY 07 and Prior	FY 08	FY09	FY10	FY11
TRI-12	Indoor Air Quality Engine Control Demonstration <i>The objective of this cooperative agreement is to support the efforts of the Zenith Fuel Systems LLC to determine the impacts on indoor air quality and HVAC costs in indoor transit facilities using propane powered forklifts with conventional and state-of-the-art fuel control systems.</i>	FTA Research	Implementation	\$844,985	▶▶▶▶▶	▶▶▶▶▶▶▶▶▶▶			
TRI-12	JSU Bus Technology Center <i>This project is designed for the establishment of a bus technology center (BTC) at Jacksonville State University (JSU) and provides for construction and implementation of the initial research and testing work for the center.</i>	FTA Research	Non-Research	\$994,100	▶▶▶▶▶	▶▶▶▶▶▶▶▶▶▶			
TRI-10	Urban Maglev Program Technical Support <i>The Volpe Center will perform the following activities to assist the FTA in the management of the Low Speed Maglev Program: 1. Conduct Program Planning activities; 2. Evaluate and synthesize results; 3. Conduct Workshops/seminars; 4. Develop reports for industry use; and, 5. Provide other support to FTA upon request</i>	FHWA	Analysis	\$300,000	▶▶▶▶▶	▶▶▶▶▶▶▶▶▶▶			
TRI-10	Maglev 2000 of Florida <i>This project includes the construction of guideway, the manufacture and assembly of coil panels and superconducting magnets, and the development of a prototype vehicle to demonstrate vehicle levitation in-place. Technical documentation of construction and component assembly and the resulting operating and power costs is being developed. The results will examine the viability of superconducting magnets for levitation under static conditions.</i>	FHWA	Development	\$1,000,000	▶▶▶▶▶	▶▶▶▶▶▶▶▶▶▶			
TRI-10	Urban Magnetic Levitation Transit - Colorado DOT <i>The CDOT Team designed an urban maglev system using parameters and constraints derived for the terrain and weather condition for the Denver, CO Metropolitan Area. The project addressed an evaluation concept, developed a prototype subsystem and performed system integration and planning activities. The Final Research Reports capture lessons-learned and information that would be fruitful to other rail transit agencies, if they decide to implement a Low Speed Urban Maglev System.</i>	FHWA	Analysis	\$4,242,000	▶▶▶▶▶	▶▶▶▶▶▶▶▶▶▶			
TRI-11	Rich Passage Passenger Only Ferry Service <i>Cooperative agreement supports the efforts of WSDOT to test passenger-only ferry technologies. The Rich Passage Wake Study will test technologies including vessel hull design and composition, propulsion systems, prototype vessel and operating speeds, against various types of shorelines.</i>	FTA Research	Analysis	\$774,135	▶▶▶▶▶	▶▶▶▶▶▶▶▶▶▶			

Legend –

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FTA Office	Project Title and Description	Funding Source	Project Type	Obligated Funding*	Timeframe				
					Ending in FY 07 and Prior	FY 08	FY09	FY10	FY11
TRI-10	California University of Pennsylvania Sky Shuttle System Maglev <i>Inadequate space for road expansion, steep terrain and other problems make it a suitable candidate for maglev transportation on an elevated guideway at CUP. The maglev system chosen by CUP and Pennsylvania DOT is the system under development by General Atomics in San Diego. This project funds CUP's efforts to conduct research in select areas of Low Speed Maglev Technology as part of FTA's Maglev Program.</i>	FHWA	Development	\$2,000,000	▶▶▶▶▶	▶▶▶▶▶	▶▶▶▶▶		
TAD	E-Government Initiatives Agency contribution towards Departmental requirement to support several government-wide E-Government initiatives.	FTA Research	Non-Research	\$172, 138 (06 approval)	▶▶▶▶▶	▶▶▶▶▶	▶▶▶▶▶	▶▶▶▶▶	▶▶▶▶▶
TBP	Managerial Cost Accounting Funds will be used for the development and testing of a cost accounting system that allocates internal resources such as salaries, equipment, and program resources to specific activities and programs.	FTA Research	Non-Research	\$1,003,903	▶▶▶▶▶				
TRO	Hennepin County Community Works <i>This program supports local planning projects in Hennepin County, Minnesota</i>	FTA Research	Analysis	\$1,192,920	▶▶▶▶▶				
TRO	Wisconsin Supplemental Transportation Rural Assistance Program <i>This projects funds capital projects, operations, purchase or lease of vehicles, and integration, planning and coordination of public transportation services in the State of Wisconsin that will supplement and expand existing rural and special public transportation services.</i>	FTA Research	Implementation	\$1,980,000 (06 approval)	▶▶▶▶▶	▶▶▶▶▶	▶▶▶▶▶		
TRI	Trauma Care System Research and Development <i>For trauma care system research and development at the University of Alabama in Birmingham.</i>	FTA Research	Development	\$495,000 (06 approval)	▶▶▶▶▶	▶▶▶▶▶	▶▶▶▶▶		
TRI	Transportation Infrastructure and Logistics Research <i>For transportation infrastructure and logistics research at the University of Alabama in Huntsville.</i>	FTA Research	Analysis	\$495,000 (06 approval)	▶▶▶▶▶	▶▶▶▶▶	▶▶▶▶▶		
TRI	Application of Information Technology To Transportation Logistics and Security <i>For research on the application of information technology to transportation logistics and security at the University of Kentucky</i>	FTA Research	Analysis	\$396,000 (06 approval)	▶▶▶▶▶	▶▶▶▶▶	▶▶▶▶▶		

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5.0 PERFORMANCE MEASUREMENT

FTA’s research program includes the following performance objectives:

1. Ensure that 90 percent of the projects are on-time and on-budget;
2. Increase transit ridership by 1 percent per year;
3. Reduce transit fatalities; and,
4. Deliver a total of 30 innovations/products by 2010 across the goals.

These performance objectives are associated with DOT goals and FTA research goals as shown in Table 5-1.

Table 5-1. Performance objectives align with FTA and DOT goals.

DOT Goals	FTA Research Goals	Performance Objective
Organizational Excellence	Goal 1: Provide transit research leadership	90% projects on time and on-budget
Mobility	Goal 2: Increase transit ridership	Increase ridership 1% per year
		Support performance objective #4 (see above)
Global Connectivity	Goal 3: Improve capital and operating efficiencies	Support performance objective #4 (see above)
Safety	Goal 4: Improve safety and emergency preparedness	Reduce transit fatalities
Security		Support performance objective #4 (see above)
Environmental Stewardship	Goal 5: Protect the environment and promote energy independence	Support performance objective #4 (see above)

Measuring performance against the four objectives at the research program level depends on the ability to aggregate performance at the project level against the objectives. For three of the four objectives, this measurement is not straightforward, because a direct relationship does not exist between the success of the projects and the achievement of the research goals. Therefore, as described below, an interim process and performance measures were developed to determine project performance against expected research outcomes. FTA will use the findings from this process as a starting point for developing a more complete set of project performance objectives and more comprehensive method for measuring performance at the program level.

Depending on their purpose and stage of development, research projects can be categorized as one of four types:

- *Analysis* – includes basic research and analysis, planning, technical assistance, best practices, evaluation, scans, and testing

- *Development* – includes standards, specifications, guidelines, technology, hardware, software, demonstrations and infrastructure
- *Implementation* – includes the deployment and use of technology, hardware, software and infrastructure
- *Training and capacity building* – includes the development and delivery of training courses and human resource-related projects

The expected outcomes of different types of projects will differ. For example, an analysis project may yield a technology concept, whereas a development project may translate a concept into a set of requirements and/or specifications. Performance measures for an analysis project will also differ from performance measures for an implementation project because the two have inherently different expected outcomes. Thus, categorizing FTA-funded research projects into types allows better definition of expected outcomes and performance measures.

The method for measuring the performance of each project is to use a checklist that will be completed by the project manager. Tables 5-2, 5-3, 5-4, and 5-5, respectively, show example checklists for the four project types: analysis, development, implementation, and training and capacity-building. By answering the appropriate series of questions, the project manager will evaluate the outcomes of the project and determine the project’s performance against objectives.

Table 5-2. Performance Checklist for Analysis Projects

Outcome	Yes	No
a. Report published?	<input type="checkbox"/>	<input type="checkbox"/>
b. Paper(s) published in peer-reviewed journal?	<input type="checkbox"/>	<input type="checkbox"/>
c. Results presented in industry conference(s), workshop(s), etc?	<input type="checkbox"/>	<input type="checkbox"/>
c. Project received awards or citations?	<input type="checkbox"/>	<input type="checkbox"/>
d. Has follow-on research been identified?	<input type="checkbox"/>	<input type="checkbox"/>
e. Has a subsequent development project been identified?	<input type="checkbox"/>	<input type="checkbox"/>
f. Has a subsequent development project been initiated?	<input type="checkbox"/>	<input type="checkbox"/>
g. Has the project met its research objectives?	<input type="checkbox"/>	<input type="checkbox"/>
h. What, if any, other products or projects were created as a result of this project?		
i. Is this project on schedule, or was it completed on-time?	<input type="checkbox"/>	<input type="checkbox"/>
j. Is this project on budget, or was it completed on budget?	<input type="checkbox"/>	<input type="checkbox"/>

Table 5-3. Performance Checklist for Development Projects

Outcome	Yes	No
a. Were standards published?	<input type="checkbox"/>	<input type="checkbox"/>
b. Were standards adopted?	<input type="checkbox"/>	<input type="checkbox"/>
c. Were specifications published?	<input type="checkbox"/>	<input type="checkbox"/>
d. Were guidelines published?	<input type="checkbox"/>	<input type="checkbox"/>
e. Was a best practices handbook published?	<input type="checkbox"/>	<input type="checkbox"/>
f. Was a lessons learned report published?	<input type="checkbox"/>	<input type="checkbox"/>
g. Was other documentation published? If yes, specify: _____	<input type="checkbox"/>	<input type="checkbox"/>
h. Did the project result in a prototype?	<input type="checkbox"/>	<input type="checkbox"/>
i. Did the project result in a commercially-viable technology or product (software or hardware)?	<input type="checkbox"/>	<input type="checkbox"/>
i1. If yes, is the product ready for deployment or use?	<input type="checkbox"/>	<input type="checkbox"/>
j. Is the transit industry aware of product?	<input type="checkbox"/>	<input type="checkbox"/>
j1. If yes, how many transit agencies might use this product?	Number of agencies _____	
k. Has this product received any awards or citations?	<input type="checkbox"/>	<input type="checkbox"/>
l. Has any follow-on activity, such as implementation/ deployment been identified?	<input type="checkbox"/>	<input type="checkbox"/>
m. Has any follow-on activity, such as implementation/ deployment been initiated?	<input type="checkbox"/>	<input type="checkbox"/>
n. Did the project meet its development objectives?	<input type="checkbox"/>	<input type="checkbox"/>
o. Did new products or projects result from this project? If yes, specify: _____	<input type="checkbox"/>	<input type="checkbox"/>
p. Is this project on schedule, or was it completed on-time?	<input type="checkbox"/>	<input type="checkbox"/>
q. Is this project on budget, or was it completed on budget?	<input type="checkbox"/>	<input type="checkbox"/>

Table 5-4. Performance Checklist for Implementation Projects

Outcome	Quantitative/Qualitative Results	
a. What was the duration of the implementation (in months)?		
b. Identify the following project results:		
b1. Reduction in operating costs		
b2. Reduction in fatalities, injuries and accidents/ improved safety		
b3. Increase in customer satisfaction		
b4. Increase in ridership		
b5. Increase in productivity (persons per vehicle hour)		
b6. Improvement in operational effectiveness/efficiency		
b7. Reduction in emissions, energy consumption and overall environmental impact		
b8. Reduction in travel time and travel time variability		
b9. Other appropriate measures for project (e.g., improvement in on-time performance). If yes, specify: _____		
c. Is this project on schedule, or was it completed on-time?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
d. Is this project on budget, or was it completed on budget?	Yes <input type="checkbox"/>	No <input type="checkbox"/>

Table 5-5. Performance Checklist for Training and Capacity Building Projects

Outcome	Yes	No
a. Was a training course developed?	<input type="checkbox"/>	<input type="checkbox"/>
b. Was a training course delivered?	<input type="checkbox"/>	<input type="checkbox"/>
b.1 If yes, who was your audience:	Total number of course participants _____	Total number of agencies represented by participants _____
c. Approximate percent of the target market trained	%	
d. How was the training delivered (e.g., classroom, web-based, teleconference, other)?		
e. Did the course meet the training need?	<input type="checkbox"/>	<input type="checkbox"/>
f. Is this project on schedule, or was it completed on-time?	<input type="checkbox"/>	<input type="checkbox"/>
g. Is this project on budget, or was it completed on budget?	<input type="checkbox"/>	<input type="checkbox"/>

6.0 PATH FORWARD

The next steps of this strategic planning process include addressing new/future project ideas and analyzing the existing and nearly-completed research projects. The new/future project ideas must be analyzed to determine: 1) if the work suggested is already under way or easily added to existing contracts and 2) if the suggested work is appropriate at this time.

At the same time as this analysis of the new/future project ideas is being completed, the existing FTA research project results need to be analyzed against the FTA's strategic goals and objectives for the FY 2006 Annual Report. This analysis was recommended by the TRAC in the second letter report:

“Finally, the committee urges FTA to evaluate the outputs of all its investments in research, including the earmarked research, against the objectives of the strategic research plan. A synopsis of ongoing and recently completed research as it relates to the plan's high-level goals could then be shared with Congress and other stakeholders on a routine basis.”

As discussed in Section 5.0, more work is needed in defining and developing a performance measurement process at a program level. Tools for performance measurement also need to be implemented within TRI. In addition, FTA research grantees need to be briefed and/or trained on performance measures.

FTA will continue its research program planning. Updates will be included in the next Multi-Year Research Program Plan (FY 2008 – FY 2012), which is expected to be completed by the end of FY 2007.

APPENDIX A – PROGRAM FUNDING LEVELS

The following tables describe the purpose and funding levels for each of FTA’s research program. In addition, the tables highlight the Strategic Goals supported by each program as well as general characteristic of the program in terms of levels of project risk and project Project Completion Dates. Funding levels are those authorized by SAFETEA-LU.

National Research and Technology Program (49 USC 5314, 49 USC 5312)			
Administered by FTA for both earmarked and discretionary research, development, demonstration, and deployment projects. FTA may make grants, contracts, cooperative agreements, or other agreements for research, development, demonstration, and deployment projects, and evaluation of technology of national significance to public transportation. This research should either improve public transportation service or help public transportation service meet the total transportation needs at a minimum cost.			
Strategic Goals: Across all 5 areas		Risk: Low & High Risk	
Project Completion Date: Short and Long Term		Reward: Low & High Reward	
FY2006	FY2007	FY2008	FY2009
\$53,658,000 ³⁰	\$40,400,000	\$44,600,000	\$48,450,000

Transit Cooperative Research Program (TCRP) (49 USC 5313)			
Administered by the Transportation Research Board of the National Academies of Sciences, TCRP funds research for innovative near-term solutions in response to the needs of transit service providers. Projects are competitively selected for a variety of transit research fields including planning, service configuration, equipment, facilities, operations, human resources, maintenance, policy, and administrative practices.			
Strategic Goals: Loosely aligned to 4 goals		Risk: Low	
Project Completion Date: Short Term		Reward: Low & High	
FY2006	FY2007	FY2008	FY2009
\$9,000,000	\$9,300,000	\$9,600,000	\$10,000,000

³⁰ An additional \$17.028 million was appropriated above the SAFETEA-LU level of \$37.7 Million.

University Transportation Centers (UTC) (49 USC 5506)			
Administered by the Research and Innovative Technology Administration, funds are transferred to universities designated by Congress to advance significantly the state-of-the-art in transportation research and expand the workforce of transportation professionals through research, education, and technology transfer.			
Strategic Goals: Loosely aligned to 4 goals		Risk: Low	
Project Completion Date: Short Term		Reward: Low	
FY2006	FY2007	FY2008	FY2009
\$7,000,000	\$7,000,000	\$7,000,000	\$7,000,000

National Transit Institute (49 USC 5315)			
Administered by Rutgers University, the National Transit Institute develops and conducts training for Federal, State, and local transportation officials and members of the transit industry on public transportation issues.			
FY2006	FY2007	FY2008	FY2009
\$4,300,000	\$4,300,000	\$4,300,000	\$4,300,000

Bus Testing Facility (49 USC 5309, 49 USC 5318)			
Administered by Penn State University, all new bus models acquired using FTA funds must be tested at the facility for maintainability, reliability, safety, performance (including braking performance), structural integrity, fuel economy, emissions, and noise.			
FY2006	FY2007	FY2008	FY2009
\$3,000,000	\$3,000,000	\$3,000,000	\$3,000,000

National Fuel Cell Bus Technology Development Program			
FTA will select up to three geographically disperse consortiums to conduct fuel cell bus technology and infrastructure research to facilitate the development of commercially available fuel cell bus technology.			
FY2006	FY2007	FY2008	FY2009
\$11,250,000	\$11,250,000	\$12,750,000	\$13,500,000