

FTA RESEARCH

FEDERAL TRANSIT ADMINISTRATION

FTA Report on 2015 Section 5312 Projects

FEBRUARY 2016

FTA Report No. 0091

PREPARED BY

Mary A. Leary, Ph.D., Director
Edwin Rodriguez, Transportation Management Specialist
Office of Research Management, Innovation, and Outreach
Office of Research, Demonstration and Innovation
Federal Transit Administration



U.S. Department of Transportation
Federal Transit Administration

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SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liter	L
ft³	cubic feet	0.028	cubic meters	m ³
yd³	cubic yards	0.765	cubic meters	m ³
NOTE: volumes greater than 1000 L shall be shown in m ³				
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
TEMPERATURE (exact degrees)				
°F	Fahrenheit	$\frac{5}{9}(F-32)$ or $(F-32)/1.8$	Celsius	°C

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13. ABSTRACT This report provides information on projects funded by the Federal Transit Administration's Section 5312 program for 2015 and a proposed allocation of appropriated funds for FY 2016. FTA focused eligible projects in three strategic priority areas to promote innovation that improves operations, infrastructure, and the travelers' experience, including safety, asset management and asset innovation, and mobility. Total amounts for FTA-funded projects across the three types of MAP-21 eligible projects include Research projects (\$10 million, 7% of 2015 allocations) for public transportation projects that develop and deploy new and innovative ideas, practices, and approaches; Innovation and Development projects (\$11 million, 8%) that improve public transportation systems nationwide to provide more efficient and effective delivery of public transportation services including through technology and technological capacity improvements; and Demonstration and Deployment projects (\$114 million, 85%) for the early deployment and demonstration of innovation in public transportation that has broad applicability. Major projects are related to safety and asset management/innovation. Included in the report are project descriptions and lists of pending or ongoing project awards and grantees for larger projects. The findings of FTA's research, innovation, and demonstration programs benefit riders, providers, and all members living in communities with public transit services. New safety technologies and solutions that public transit agencies can implement will mitigate injuries and fatalities. New, more energy-efficient capital will continue to reduce harmful emissions and reduce energy costs. Advancements in mobility through shared public and private services mean more people can get a ride when and where they need it. Operational processes that track important data for transit agency operational efficiency reduce provider costs. Innovations in capital stimulate the economy and boost private sector businesses. FTA's 2015 research activities are driving the development of many useful resources for the industry. Innovative research and demonstration grants are in process with impending recommendations for technologies that hold great promise to improve public transportation systems and travel. Projects are assessing new operational processes, piloting more efficient ways to schedule a ride, testing systems for monitoring rider and passenger safety, funding innovative improvement to buses that reduce emissions and energy use, and demonstrating and deploying real-world solutions across the three priorities of safety, asset management/asset innovation, and mobility.			
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U.S. Department
of Transportation

**Federal Transit
Administration**

Headquarters

1200 New Jersey Avenue, SE
Washington, DC 20590

Dear Colleague:

I am pleased to provide you with a copy of the Federal Transit Administration (FTA) Report on Fiscal Year (FY) 2015 Section 5312 Projects. This comprehensive report presents detailed FY funding information for FTA's major research programs. FTA invested almost \$136 million in FY 2015 and previous FY appropriations for ongoing or new projects in three strategic priority areas: research projects, innovation and development projects, and demonstration, deployment, and evaluation projects as authorized by Moving Ahead for Progress in the 21st Century (MAP-21). FTA will continue its investments under the Fixing America's Surface Transportation (FAST) Act. These investments are leading innovation and change across the public transportation industry through many affiliations, stakeholder engagements, and collaborations. Essential components of cooperative agreements are field-based demonstration grants that test promising practices across the following three strategic priority areas:

- Research Projects – \$10 million (7%) for public transportation projects to develop and deploy new and innovative ideas, practices, and approaches;
- Innovation and Development Projects – \$11 million (8%) for projects to improve public transportation systems nationwide to provide more efficient and effective delivery of public transportation services including through technology and technological capacity improvements; and
- Demonstration and Deployment Projects and Evaluation – \$114 million (85%) for early deployment and demonstration of innovation in public transportation that has broad applicability, including low or no emission vehicle deployment. Projects in this area require a comprehensive evaluation within two years of being funded; the major projects in this category were in safety and asset management/asset innovation.

In 2015, active projects funded under Section 5312 spanned 19 areas of inquiry: 4 for safety, 6 for mobility, and 9 for asset management and asset innovation. The report provides details of these projects, including their purpose, relevance to the industry, national significance, and timeframes for completion.

I hope you will find this report useful and informative. Thank you for your continued interest in research and public transportation.

Sincerely,

Vincent Valdes
Associate Administrator
Office of Research, Demonstration, and Innovation

ABSTRACT

This report provides information on projects funded by the Federal Transit Administration's Section 5312 program for 2015 and a proposed allocation of appropriated funds for FY 2016. FTA focused eligible projects in three strategic priority areas to promote innovation that improves operations, infrastructure, and the travelers' experience, including safety, asset management and asset innovation, and mobility. Total amounts for FTA-funded projects across the three types of MAP-21 eligible projects include Research projects (\$10 million, 7% of 2015 allocations) for public transportation projects that develop and deploy new and innovative ideas, practices, and approaches; Innovation and Development projects (\$11 million, 8%) that improve public transportation systems nationwide to provide more efficient and effective delivery of public transportation services including through technology and technological capacity improvements; and Demonstration and Deployment projects (\$114 million, 85%) for the early deployment and demonstration of innovation in public transportation that has broad applicability. Major projects are related to safety and asset management/innovation. Included in the report are project descriptions and lists of pending or ongoing project awards and grantees for larger projects. The findings of FTA's research, innovation, and demonstration programs benefit riders, providers, and all members living in communities with public transit services. New safety technologies and solutions that public transit agencies can implement will mitigate injuries and fatalities. New, more energy-efficient capital will continue to reduce harmful emissions and reduce energy costs. Advancements in mobility through shared public and private services mean more people can get a ride when and where they need it. Operational processes that track important data for transit agency operational efficiency reduce provider costs. Innovations in capital stimulate the economy and boost private sector businesses. FTA's 2015 research activities are driving the development of many useful resources for the industry. Innovative research and demonstration grants are in process with impending recommendations for technologies that hold great promise to improve public transportation systems and travel. Projects are assessing new operational processes, piloting more efficient ways to schedule a ride, testing systems for monitoring rider and passenger safety, funding innovative improvement to buses that reduce emissions and energy use, and demonstrating and deploying real-world solutions across the three priorities of safety, asset management/asset innovation, and mobility.

EXECUTIVE SUMMARY

The Federal Transit Administration (FTA) drives public transportation innovation with projects of national significance to improve our nation's public transportation. Section 5312 of Title 49 U.S.C., as amended by the Moving Ahead for Progress in the 21st Century (MAP-21) outlines three types of eligible projects: research projects; innovation and development projects; and demonstration, deployment, and evaluation projects. Typically, research and innovation projects are applied research, while demonstration and deployment projects are development. In 2015, FTA focused eligible projects in three strategic priority areas to promote innovation that improves operations, infrastructure, and the travelers' experience. These strategic priorities are: safety, asset management and asset innovation, and mobility. FTA's research management, innovation, and demonstration activities develop through a pipeline phased approach beginning with research, innovation/deployment, and small business innovative research projects which stimulate creation of demonstration, deployment, and evaluation activities. The priorities, pipeline process, and commensurate partnerships promote FTA's strategic goals of economic competitiveness, environmental sustainability, and improving the quality of life in communities' by expanding rides to health/wellness, education, employment, recreation, and social connections.

FTA's Office of Research, Innovation, and Demonstration (TRI) use Section 5312 investments to leverage a collective perspective of stakeholders. TRI places a significant emphasis on partnerships to achieve research goals. TRI leadership and staff were visible at important industry events presenting, connecting, involving, and gathering input across state/local governmental entities; other Federal laboratories; providers of public transportation; private or nonprofit organizations; and technical/community colleges to achieve FTA's research goals. Key stakeholder engagements included events with its modal partners, such as the Volpe National Transportation Systems Center, the Intelligent Transportation Systems (ITS) Joint Program Office, the Federal Highway Administration (FHWA), and DOT's Office of Research (OST-R). FTA awards cooperative agreements, contracts, and other eligible agreements across broad stakeholder groups to ensure the highest level of industry impact once projects are completed, and to ensure effective dissemination of results.

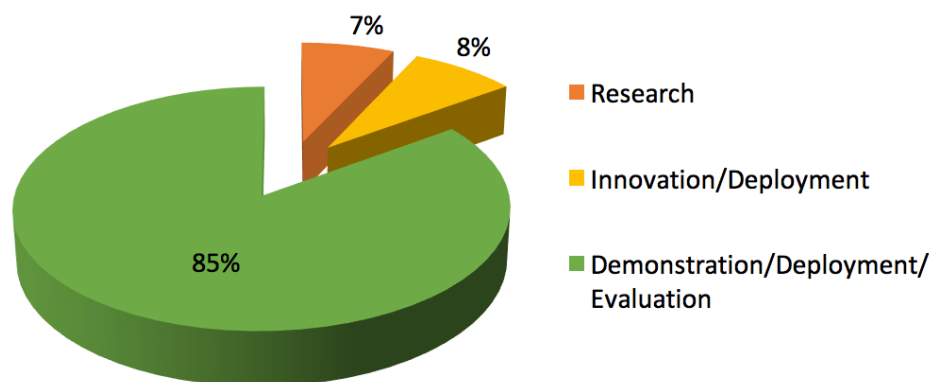
FTA projects achieve public transportation innovation goals by utilizing one or more of the following strategic directions:

- Enhancing equitable and accessible mobility for everyone;
- Encouraging public private partnerships;
- Ensuring public transportation efficiency, safety and reliability;
- Enabling seamless, effective integration across transportation modes and applications; and
- Expanding customer satisfaction and value.

Below are the total amounts of FTA funded projects across the three MAP-21 types of eligible projects:

- **Research Projects:** \$10 million or seven percent of public transportation projects develop and deploy new and innovative ideas, practices and approaches;
- **Innovation and Development Projects:** \$11 million or eight percent of projects improve public transportation systems nationwide in order to provide more efficient and effective delivery of public transportation services including through technology and technological capacity improvements;
- **Demonstration and Deployment Projects and Evaluation:** By far the predominance of projects—\$114 million or 85 percent of 2015 activities—are for early deployment and demonstration of innovation in public transportation that has broad applicability—this category includes low or no emission vehicle deployment. Projects in this area require a comprehensive evaluation within two years of being funded. The major projects in this category were in safety and asset management/innovation.

Table 1
Types of FTA
Research Projects

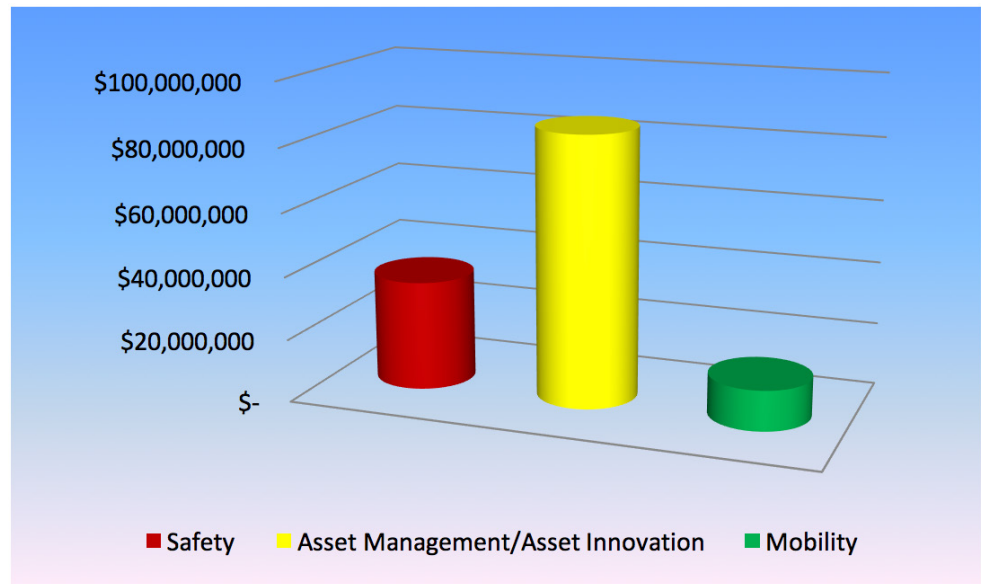


Appendix 2 through Appendix 4 provide a list of local grantees for several large demonstration and deployment initiatives. Research and innovation projects are often awarded to prestigious academic institutions, public research laboratories, and other leading organizations in various public transportation disciplines. This mix of local, state, regional, and national grantees ensures a spectrum of perspectives that enhance the reliability, validity, and generalizability of research findings.

Strategic Priorities in Research and Innovation—Safety, Asset Management/Innovation, and Mobility

FTA invested almost \$136 million in Fiscal Year 2015 and previous Fiscal Year appropriations for ongoing or new projects in three strategic priority areas: safety, asset management and asset innovation, and mobility. FTA's investments are leading innovation and change across the public transportation industry through many affiliations, stakeholder engagements, and collaborations. Essential components of cooperative agreements are field based demonstration grants that test out promising practices across the three strategic priority areas. The chart below shows the breakout of allocations across these three areas:

Table 2
Fund Allocation
Across FTA Strategic
Research Priorities



In 2015, active projects spanned 19 areas of inquiry: four for safety, six for mobility, and nine for asset management and asset innovation. The large percentage of funding allocated to asset management and asset innovation—64 percent—reflects the history and requisite focus on capital and equipment for public transportation. The majority of Federal formula grants in public transportation pay for major capital investments and infrastructure, so ensuring effective management of these assets and supporting innovation to reduce emissions and improve fuel efficiency is a long-standing area of research and demonstration. Safety is the second highest area of funded research – 26 percent – and is a continued critical focus for passengers and operators. Also increasing in importance with the fast pace of transportation technologies and smart-phone applications providing real-time data for travelers and providers, mobility will continue to grow from its current nine percent share of FTA research dollars to far more in the future.

The priority of safety research, innovation and demonstration is the improvement of public transportation safety. Within the U.S. DOT's *Transportation for a New Generation - Strategic Plan Fiscal Years 2014-18*, improving safety throughout the transportation sector is one of FTA's highest priorities, and projects are focused on reducing transit-related fatalities and injuries. New projects in 2015 supported FTA's new regulatory role and its responsibility to develop a safety oversight framework. Safety were supported by \$28 million in Innovative Safety, Resiliency, and All-Hazards Emergency Response and Recovery Research Demonstrations (SRER) projects. In addition, the resurgence of walkability, the growing number of bicyclists, increased transit use, and more transit vehicles operating in mixed traffic translate into increased challenges which require research and innovation assessments for enhancing pedestrian and bicyclists' safety. FTA allocated almost \$35 million of 5312 funds to support public transportation safety initiatives.

Asset management and asset innovation are a priority that directly addresses the U.S. DOT Environmental Sustainability strategy to promote the development and deployment of technologies to reduce the energy consumption and greenhouse gas (GHG) emissions of transit systems. This strategic priority includes activities supporting important goals and objectives for the state of good repair. FTA undertook research on zero-emission vehicles, facilities, and technologies to identify innovative and sustainable uses of transit vehicles and services. Asset management and asset innovation was improved through almost \$4 million in Bus Efficiency Enhancements Research and Development; and over \$77 million in the statutorily required Low or No Emission Vehicle Deployment Programs. There is a long history of FTA foundational research in advanced bus technologies for both environmental benefits as well as operational efficiencies. FTA approved an additional \$2.75 million in 2015 to support zero emissions research, which is scheduled to begin in 2016. FTA also invested in projects that study how life-cycle costs impact asset investment decisions. Projects provide essential information for the public transportation industry and operators to think strategically about asset management and innovation. FTA invested \$88 million in support of asset management and asset innovation research activities. These projects support both DOT and FTA's strategic goals related to state of good repair and environmental sustainability.

FTA allocated approximately \$13 million of Section 5312 investments on mobility—an important and emerging area of research, innovation, and demonstration. FTA's activities continue in the traditional use of the term which primarily focused on accessibility. But, there is a growing focus on research and innovation activities that assess how public transportation can benefit from the paradigm shift occurring in shared services between the public and private sector. Trends in technology are expanding traveler-centric and on-demand resources. FTA launched a major initiative called Mobility on Demand (MOD) which builds upon many years of findings from the Mobility Services for All Americans' Joint Program Office projects. The priority of enhancing mobility research is to encourage the development of complementary and supplemental mobility options that expand partnerships with private sector services such as those by transportation network services companies like Lyft and Uber to enhance the experience of public transportation travelers.

Overall, mobility projects are improving the efficiency, effectiveness, and quality of public transportation services through adaptation to new mobility options by public transportation providers that increase geographic coverage, service times, address 'last mile' issues for travelers, and ensure accessibility. Transformative and, at times, disruptive technologies are driving massive changes in the way customers access and use public transportation and transportation information. New technologies are enabling greater levels of accessibility for people living with disabilities of all ages. Research and innovation projects showed promising ways to help people accurately plan, and safely navigate trips both inside and outside.

FTA's small business innovation research (SBIR) is helping small businesses explore entrepreneurial efforts to expand mobility. Early results in research laboratories demonstrated solutions that help a person who is blind or has low vision attain higher levels of independence in travel. Testing is ongoing with transponders in buses that reduce pedestrian and bicyclist injuries. FTA is working closely with FHWA to collaborate on the Accessible Transportation Technology Research Initiative (ATTRI), and over the last year supported numerous research forums, stakeholder engagement sessions, and participatory research. The definition of "mobility" is changing dramatically with the rise of many new multimodal options. Options such as mobile way-finding, bicycling (including bikesharing), on-demand ridesharing, and even a possible future that includes autonomous vehicles means that mobility options will alter the nature of public transit. FTA's activities in 2015 formed a baseline and foundation for even larger investments in 2016 and beyond to ensure the public transportation industry maintains a leadership role as these changes unfold in America's communities.

Below is a table that summarizes funding allocation for ongoing, new, or planned projects in 2015.

Table 3

FTA MAP-2I Section 5312 Research Investments 2015

Federal Transit Administration MAP-2I Section 5312 Research Investments				
	Safety	Asset Management/ Asset Innovation	Mobility	Totals
Research	\$1,500,000	\$2,050,000	\$6,500,000	\$10,050,000
Innovation/Development	\$3,000,000	\$5,120,271	\$3,261,725	\$11,381,996
Demonstration/Deployment	\$30,300,000	\$80,964,347	\$2,997,970	\$114,262,317
Totals	\$34,800,000	\$88,134,618	\$12,759,695	\$135,694,313

Please see Appendix I.

Table 4

FTA Section 5312 Research Investments 2015 by DOT Goal/MAP-2I Priority Areas

Federal Transit Administration 2015 Active and Approved Section 5312 RD&T Projects by DOT Goal/MAP-2I Priority Areas				
Safety	State of Good Repair	Livable Communities	Environmental Sustainability	Total
26%	4%	9%	61%	100%
\$34,800,000	\$5,385,699	\$12,759,695	\$82,748,919	\$135,694,313

The Road to Demonstration and Deployment Investments

FTA's research management, innovation, and demonstration activities develop through a pipeline phased approach beginning with research, innovation/ deployment, and small business innovative research projects which stimulate

creation of demonstration, deployment, and evaluation activities. In calendar year 2015, FTA allocated over 85 percent of its research assets to demonstration and deployment projects as well as project evaluation activities to ensure effective translation of promising projects into practice. As required by statute, projects build upon each other to facilitate deployment of research and technology development resulting from private efforts or Federally funded efforts; the implementation of research and technology development to advance the interests of public transportation; or the deployment of low or no emission vehicles, zero emission vehicles, or associated advanced technology.

In 2015, FTA's investments supported ENHANCEMENTS TO SAFETY AND ASSET MANAGEMENT/ASSET INNOVATION with more than two dozen projects in three demonstration and deployment programs.

The Road Ahead in 2016

FTA's 2016 strategic research plan will continue for the foreseeable future with the three major priority areas discussed earlier and within the project types that remain unchanged in 49 U.S. C. 5312 as amended by the Fixing America's Surface Transportation (FAST) Act. To support strategic planning, FTA is re-starting its external stakeholder group through the National Academies of Sciences Transit Analysis Research Committee (TRAC). TRAC was dormant since 2012, and FTA is excited to be restarting this important outreach and advisory activity with external stakeholders' assistance in the development of a longer-term Strategic Research Plan. FTA will also engage important partners like the American Public Transportation Association, (APTA), the Volpe National Transportation Systems Center, Intelligent Transportation Society of America (ITS America), the Community Transportation Association of America, University Transportation Centers, and other academic institutions across the United States. FTA is going to develop a new five year strategic plan to ensure research investments are responsive to current public transportation trends, challenges, and needs. Additionally, for 2016, FTA's TRI is leading a new project planning activity across FTA's respective functions to provide a venue for transparent and participatory decision-making to allocate the \$20 million of FAST Act FY2016 Section 5312 appropriations. The remaining \$8 million authorized and appropriated will be used to create a new low or no emission component testing program [5312(b)(3)(H) for \$3 million] and \$5 million will be used to continue the Transit Cooperative Research Program with the National Academies of Sciences [5312(b)(3)(I)].

FTA is uniquely positioned to drive research projects to ensure public transit agencies benefit from the fast rate of change being experienced in the domestic public transportation industry. No other public sector entity is solely concerned

with the issue of transit research, innovation and demonstration at the national level, and no other federal agency focuses on the public transportation industry. TRI is proud of the accomplishments of 2015 research projects and the foundation they will provide for future investments.

Requirement for this Report

MAP-21 required a report on research to the Committee on Banking, Housing, and Urban Affairs and the Committee on Appropriations of the Senate and the Committee on Transportation and Infrastructure, the Committee on Science, Space, and Technology, and the Committee on Appropriations of the House of Representatives. The FAST Act amended this requirement that when completed, the report must now be posted on FTA's website and provide:

- A description of each project that received assistance under Section 5312 in the preceding year; and
- An evaluation of each project that received assistance in the preceding year including any evaluation conducted for demonstration and deployment projects.

This report provides the required information by major FTA priority area of the projects. This format will continue for the 2016 report requirement for the FAST Act.

Background

In FY 2015, the FTA Office of Research, Demonstration and Innovation (TRI), largely in response to an outdated Strategic Research Plan and the need to better align existing resources with strategic research areas, developed a two-year interim “Research Business Plan” (Plan). This Plan identified the three strategic priority areas for FTA investments and research efforts over the next two years, particularly within the statutory framework for MAP-21. MAP-21 provides the authority for FTA to fund a pipeline of projects across the entire research lifecycle from proof of concept to deployments, and ultimately evaluation.

Using the strategic investment areas, FTA developed its annual Research Program Plan, which enabled Acting Administrator Therese W. McMillan to allocate all of the available MAP-21 resources authorized under 49 U.S.C. 5312. In July 2015, Acting Administrator McMillan approved \$17.15 million in Section 5312 appropriations (appropriated in FY 2014 and 2015) to projects in support the three key research areas of: safety, mobility, and asset innovation and asset management.

Project Descriptions

Detailed descriptions of projects funded by FTA under 49 U.S.C. 5312 are categorized first by each priority area—safety; asset management and asset innovation; and mobility—and then by when they were scheduled to receive funding. Projects were either approved in FY 2015, but could not be obligated until 2016 due to the shift in grants management systems; funded and begun in FY 2015; or were ongoing in FY 2015 from previous year funding. Each priority area review notes the overall objective, detailed description, list of projects, outputs, and outcome/impact followed by a list of each associated project. Each project description gives the details of its grantee, purpose, national relevance of research and to the transit industry, expected final products with delivery dates, and funding amounts per year.

Improving Safety

Objective:

Research to improve public transportation safety to reduce transit-related fatalities and injuries.

Description:

FTA's new regulatory role and its responsibility to develop a safety oversight framework requires additional research. In addition, the resurgence of walkability, the growing number of bicyclists, increased transit use, and more transit vehicles operating in mixed traffic result in increased safety challenges. To develop and implement the safety research area, FTA's Office of Research works closely with FTA's Office of Safety and Oversight to identify key areas of exploration and data collection needs. FTA also will use research funds to address bus fleet safety associated with alternative fuels; study safety-enhancing practices, technologies and programs; and assess and promote traveler, pedestrian, and bicycle safety practices and policies.

Outputs:

- Identify emerging transit safety issues working in concert with the Office of Safety and Oversight and continue to finalize the safety research strategic plan;
- Study safety-enhancing practices, technologies, and programs; address bus fleet safety issues associated with alternative fuels (e.g., hydrogen, natural gas, propane, and electric, etc.); and
- Study traveler, pedestrian, and bicycle safety practices and policies.

Outcome/Impact:

- Identify specific promising practices, and operational activities that will reduce traffic injuries and fatalities.

List of Projects: (4)

1. *Safety Standards Strategic Plan Development and Data Collection Strategy*
2. *FTA Employee Safety Reporting and Confidential Close Call Reporting Pilot Program*
3. *Innovative Safety, Resiliency, and All-Hazards Emergency Response and Recovery Research Demonstrations (SRER)*
4. *Vehicle Assist and Automation (VAA) Demonstration*

Approved Projects in 2015:

In July 2015, the following projects were approved. FTA is finalizing Statements of Work (SOW) and implementation strategies for these projects, and funding will be obligated in FY 2016.

Title: Safety Standards Strategic Plan Development and Data Collection Strategy

Grantee: University of South Florida, Center for Urban Transportation Research (CUTR)

Project Purpose:

The purpose of this research is to provide background information, data analysis, and technical information to assist FTA's Office of Safety (TSO) with its effort to develop the safety standards strategic plan. The final research deliverable will inform TSO about existing transit safety standards, potential gaps in those standards and propose new standards when applicable for use by the TSO/FTA/transit industry. This research effort will not develop new transit safety standards but provide necessary information to support TSO as it develops its plan for the rollout of transit safety standards.

National Relevance of the Research:

This research meets MAP-21 and FAST Act requirements for safety standards review, evaluation and public report by FTA. The research work provides background information and strategic direction for FTA/TSO to implement the rulemaking authority on minimum safety performance standards.

Relevance to the Transit Industry and Community:

Projects will identify and recommend minimum safety standards to help FTA rollout a plan for safety standards implementation. This will enable transit industry community nationwide to implement minimum safety standards to make transit safe.

Expected Final Products and Delivery Dates:

- a Standards Progress Report for public dissemination in December 2016;
- FTA's Safety Standards Strategic Plan in June 2017; and
- a final report with minimum safety standards and data requirements in September 2017.

FTA Funding: \$1,500,000

Non-FTA Funding: 20 percent local match from CUTR

Title: *FTA Employee Safety Reporting and Confidential Close Call Reporting Pilot Program*

Grantee: Volpe National Transportation Systems Center and Transit Authorities

Project Purpose:

The objective of the FTA Close Call and Employee Safety Reporting Pilot Program is to pilot several Close Call Reporting and/or Employee Safety Reporting systems in a variety of transit agencies with different modes and service conditions. FTA would like to demonstrate the effectiveness of Close Call and Employee Reporting systems in a variety of transit operations that are representative of the transit industry. In addition, FTA would like to produce a guidance document for the industry to use when agencies are setting up their own Close Call Reporting and/or Employee Safety Reporting systems.

National Relevance of the Research:

The results of this pilot program will provide guidance to transit agencies nationwide to improve effectiveness in safety reporting with a how-to guide for setting up an Employee Safety Reporting system.

Relevance to the Transit Industry and Community:

Employee Safety Reporting and Close Call Reporting systems are essential to monitoring and improving safety.

Expected Final Products and Delivery Dates:

- The first two years will gather information from projects to yield data on the effectiveness of various Employee Safety Reporting systems.
- The delivery of the guidance documents will be roughly three years after the start of the pilot (FY2018).

FTA Funding: \$3,000,000

Non-FTA Funding: All project sponsors are contributing at least the required 20 percent share.

Assistance Received in 2015:

The following projects were started and obligated in FY 2015 from money appropriated in previous years. FTA finalized SOW's, implemented strategies for these projects, and obligated them in 2015.

Title: *Innovative Safety, Resiliency, and All-Hazards Emergency Response and Recovery Research Demonstrations (SRER)*

Grantee: Local Governments, Transit Authorities, Educational Institutions, and Private Firms

Project Purpose:

A key strategic goal of the U.S. DOT and FTA is to improve and maintain America's public transportation systems to ensure safety and state of good repair to meet performance objectives. The proposals selected for innovative research and demonstrations are intended to develop and showcase promising technologies, methods, practices, and techniques that improve public transportation systems. To this end, FTA is funding 13 projects in nine states that engage in the demonstration of innovative technologies, methods, practices, and techniques in three areas: (1) operational safety, (2) infrastructure or equipment resiliency, and (3) all-hazards emergency response and recovery methods. Under operational safety, SRER will develop and demonstrate new or substantially-improved technologies, methods, practices, and techniques that will increase the operational safety of public transportation services and reduce the risk of transit-related injuries and fatalities. Under resilience, the project will identify, develop, and demonstrate technologies, methods, practices, and techniques for increasing the resiliency of public transportation systems to natural disasters and other emergencies that result from an external cause. Under all-hazards emergency response and recovery, SRER will investigate technologies, methods, practices, and techniques that can improve communication with emergency responders in the event of emergencies, disruptions, and catastrophic failures and conduct demonstrations of the most promising methods and/or technologies in an operational environment to restore transit services. A table of the selected projects can be found in the Appendix 2.

National Relevance of the Research:

The results of these projects will be widely applicable nationwide and support FTA's efforts to promote safe public transportation and preserving the national investment in transit infrastructure through enhanced resiliency to natural disasters and other emergencies.

Relevance to the Transit Industry and Community:

Projects will develop and demonstrate new or substantially-improved, technologies, methods, practices and techniques that will increase the operational safety of public transportation services and reduce the risk of transit-related injuries and fatalities. The results of these projects will enable transit agencies to incorporate lessons learned from the demonstration projects into their own efforts to improve safety, resiliency to natural disasters, and emergency response.

Expected Final Products and Delivery Dates:

- Demonstration projects will yield data on the effectiveness of various approaches to enhancing safety, resiliency, and emergency response.
- Delivery of final reports is expected about two years after award of cooperative agreements (September 2017).
- Each project sponsor will also submit a required independent evaluation.

FTA Funding: \$29,000,000

Non-FTA Funding: All project sponsors are contributing at least the required 20 percent share.

Ongoing Projects in 2015:

The following projects were still active in 2015 but funded in previous years.

Title: Vehicle Assist and Automation (VAA) Demonstration

Grantee: California State DOT (Caltrans), Division of Mass Transit

Project Purpose:

This project will demonstrate the technical merits and feasibility of VAA technology applications in bus revenue service and assess their costs and benefits. Caltrans, partnering with AC Transit and Lane Transit District, will demonstrate the VAA applications of bus lateral control in a transitway and precision docking at bus stops using magnetic marker sensing technology. The project is being independently evaluated by the National Bus Rapid Transit Institute of the Center for Urban Transportation Research (CUTR) of the University of South Florida.

National Relevance of the Research:

Initial research has shown that VAA technologies have significant promise to provide benefits to transit agencies in terms of more efficient operations. In most cases, full technical feasibility and the benefits have not been quantified yet. The technical merits and benefits of these technologies could be fully quantified in a demonstration involving revenue service.

Relevance to the Transit Industry and Community:

Based on initial research, FTA is interested in demonstrating two viable VAA applications—precision docking and lateral guidance/control. Anticipated VAA benefits include fewer collisions, reduced maintenance costs (e.g., reduced bus

wear and tear), improved productivity and efficiency, improved travel time and reliability, reduced fuel consumption, improved bus driver satisfaction (e.g., reduced stress), and improved customer satisfaction (e.g., easier boarding, smoother ride). VAA has the potential to reduce right-of-way requirements and could provide a cost-effective bus alternative to traditional light or heavy rail systems in selected corridors. This project will provide systems engineering documentation and benefits information of two VAA applications to the transit industry and community. It is anticipated that this information will help transit agencies deploy VAA systems sooner and on wider basis.

Expected Final Products and Delivery Dates:

Final evaluation report and a final project report to FTA by the Summer of 2016.

FTA Funding: \$1,300,000

Non-FTA Funding: \$600,000 (SAFETEA LU, Section 5306 [ITS Research and Development] from the Joint Program Office

Enhancing Mobility

Objective:

Research and innovation to encourage the development of complementary and supplemental mobility options, improve the overall experience for public transportation travelers, and adapt to new mobility options by public and private transportation providers.

Description:

The definition of “mobility” is changing dramatically with the rise of new multimodal options. These fundamental changes in the way transportation service is offered also influence the form of our communities. Options such as mobile way-finding, bicycling (including bikesharing), on-demand ridesharing, and even a possible future that includes autonomous vehicles mean that mobility options—particularly in urban areas—will alter nature of public transit. The traditional transportation split between public transit and the personal automobile will give way to a traveler-centric mobility portfolio that will offer seamless service through peer auto-sharing schemes, on-demand taxi trips, demand-responsive paratransit, and other innovative transportation methods.

Outputs:

- Improve multi-modal connectivity;
- Address accessibility issues through application of innovative technologies and practices;
- Improve the quality of the traveler experience and the transit product; and
- Identify new mobility-enhancing practices and technologies.

Outcome/Impact:

Enhance travelers' experiences by improving the efficiency and effectiveness of community transportation options leveraging both public and private assets to increase the quality and accessibility of transportation options for everyone.

List of Projects: (6)

1. *Rides to Wellness*
2. *Mobility on Demand (MOD) Program*
3. *Accessible Transportation Technologies Research Initiative (ATTRI)*
4. *Veterans Transportation and Community Living Initiative (VTCLI)*
5. *Mobility Services for All Americans (MSAA)*
6. *Evaluation of Integrated Corridor Management (ICM) Transit Vehicle Data*

Approved Projects in FY 2015:

In July 2015, the following projects were approved. FTA is finalizing Statements of Work (SOW) and implementation strategies for these projects, and funding will be obligated in FY 2016.

Title: Rides to Wellness

Grantee(s): (1) Transportation Research Board and the Institute of Medicine (TRB/IOM); (2) a community scan grantee, (3) competitively chosen demonstration grant recipients; (4) Evaluation partner

Project Purpose:

Rides to Wellness is a major new initiative from FTA to build partnerships, stimulate investment, and drive change across the health and transportation sectors to ensure everyone can get a ride to the health and wellness services they need. Four key activities were approved for funding under Rides to Wellness:

1. a TRB/IOM project to gather data on the value of partnerships across the health and transportation sector;
2. a community scan to assess the local return on investment when public transportation providers can help reduce missed appointments and unnecessary hospital readmissions and help people get to free health screenings and other preventive services appointments;
3. a demonstration grant for communities to implement sustainable solutions that integrate health and transportation needs such as technology applications that facilitate scheduling a ride when a health/wellness appointment is made; and
4. an evaluation of whether these projects met their goals.

The overarching goal of the first project is to help direct a community lens to the issue of transportation access to health and wellness services and identify possible measures of value and sources of data. The project will identify the value proposition for local community providers in health and transportation

to develop partnerships and what data is available to plan, develop, and track these partnerships and the solutions they engender – especially measures that demonstrate the return on investment for local community providers relating to public transportation and health care. The project will seek out local cases where such value propositions and measures have been developed or could be. Examples include measures like missed appointments due to transportation and hospital readmissions.

National Relevance of the Research:

Health services post the Affordable Care Act are seeking to shift greater emphasis on preventive services that address chronic conditions such as heart disease, diabetes, arthritis and others. Chronic conditions account for almost 80 percent of the almost \$2.4 trillion spent on healthcare in the US. Increased partnerships between public transportation and health/wellness providers hold great promise to improve health outcomes, reduce the cost of care, and expand access to services.

Relevance to the Transit Industry and Community:

As shared services expand and more private assets become integrated with public transportation assets, greater investment in public transportation infrastructure may lead to significantly improved outcomes for people and providers in the healthcare system. Thus, it is essential to identify the value proposition for collaboration and sustainable solutions that the transit industry can implement in their communities.

Expected Final Products and Delivery Dates:

- Form a planning committee that send out a call for papers - completed in February 2016.
- Hold a research workshop to review papers and state of the practice in April 2016.
- Develop a final report on the results of the workshop.
- Do a community scan on return on investment ROI for health/transportation collaboration with a final report due around September of 2016.
- Competitive selection of grantees to implement solutions in health/transportation around June of 2016.
- A final report on ROI and promising solutions will be developed within a year of grant awards.
- After each of the three projects are complete, an evaluation of outcomes and impacts will be done within 1 year and the evaluation will take a programmatic evaluation approach rather than a project by project one so that FTA can assess the success of the Rides to Wellness initiative.

FTA Funding: \$4,000,000

Non-FTA Funding: Projects that received MAP-21 appropriations, including the demonstration grant recipients, will be required to provide the 20 percent local share.

Title: *Mobility on Demand (MOD) Program*

Grantee: Transit agencies, Local Governments, Educational Institutions, and Private Firms

Project Purpose:

Mobility on Demand (MOD) is a vision for a multimodal, integrated, automated, and connected transportation system in which personal mobility is the objective. New and innovative shared-use mobility concepts and solutions, from bike and car sharing systems to innovative demand response bus services, are providing travelers with new mobility options, which are already impacting the traditional transit market and could conceivably disrupt current public transit business and funding models. The FTA MOD research program aims to support transit agencies and communities as they navigate the dynamic, evolving landscape of personal mobility. MOD can provide travelers with enhanced mobility options, improved travel decision tools, convenient and seamless travel and fare payment, and can provide transit agencies innovative new operational models, such as solutions for first/last mile, and better leverage existing investments and improve service quality. To that end, FTA is funding projects in two areas to advance integrated MOD transit solutions. FTA engagement with MOD stakeholder to better support transit industry's awareness and readiness for MOD, and to understand impediments to implementation. The project will also increase awareness and buy-in from local stakeholders and transportation companies/vendors needed for successful deployments of integrated MOD solutions in communities.

National Relevance of the Research:

The results of these projects will be widely applicable nationwide and help FTA's efforts to promote a transportation systems equitable, accessible and safe mobility options for all travelers, and leverage the existing national investments in transit systems.

Relevance to the Transit Industry and Community:

Projects will support developing and demonstrating new model to providing traveler-centric transportation, and help transit agencies develop viable models to partner with MOD service providers. The results of these projects will enable transit agencies to incorporate lessons learned from the demonstration projects into their own efforts to improve mobility and measure the impact of the programs with appropriate measurement tools.

Expected Final Products and Delivery Dates:

- Grantee must identify tangible models for implementing MOD in a transit environment and data element recommendations to monitor the effectiveness of various approaches to enhancing mobility in a community one year after award.
- Delivery of final reports is expected two years after award of cooperative agreements (September 2017).

FTA Funding: \$2,700,000

Non-FTA Funding: All project sponsors are contributing at least the required 20 percent share.

Title: *Accessible Transportation Technologies Research Initiative (ATTRI)*

Grantee: State Departments of Transportation, Transit Authorities, and Non-Transit Providers

Project Purpose:

FTA is partnering with FHWA and contributing \$2,500,000 to ATTRI for demonstrations. The purpose of this program is to improve the mobility of travelers with disabilities through the use of Intelligent Transportation Systems (ITS) and other advance technologies to improve accessible transportation for travelers and extend all those benefits to all travelers. The ATTRI Program leads the research, development, and implantation of transformative solutions, applications, or systems for all people, including those with disabilities, to effectively plan their travel. ATTRI will enhance the capability of these travelers to reliably, safely, and independently execute their travel plans. This program leverages recent advances in vehicle, infrastructure, and pedestrian-based technologies, as well as accessible data, mobile computing, robotics, artificial intelligence, object detection, and navigation. The technologies used by ATTRI provide almost ubiquitous access to wealth of real-time situational data sources, including data specific to transportation, municipalities, point of interest, crowd-sourced information, and accessibility.

National Relevance of the Research:

ATTRI solutions will leverage advances in vehicle and infrastructure-based technologies, automation, robotics, and wireless communications. ATTRI focus to improve transportation with people with disabilities and enhance human service transportation.

Relevance to the Transit Industry and Community:

ATTRI will benefit the needs of three stakeholder groups: people with disabilities, veterans, and older adults. ATTRI will develop technological solutions to remove barriers to transportation according to four functional disabilities: visual, hearing, cognitive, and mobility.

Expected Final Products and Delivery Dates:

- New Technologies identified for future development and deployment.
Expected deliverable dates pending completion of each project.

FTA Funding: \$2,500,000

Non-FTA Funding: All project sponsors (for the demonstrations) are contributing the 20 percent match.

Ongoing Activities in 2015:

The following projects were still active in 2015 but funded in previous years.

Title: Veterans Transportation and Community Living Initiative (VTCLI)

Grantee: State Department of Transportation and Transit Authorities as Direct Recipients

Project Purpose:

The purpose of this initiative is to help veterans, military families, and others connect to jobs and services in their communities by improving access to local transportation options. This federally-coordinated partnership makes it easier for U.S. veterans, active service members, military families, and others to learn about and arrange for locally-available transportation services that connect them with work, education, health care, and other vital services in their communities. FTA obligated \$3,189,744 under Section 5312 program funds for projects in urban, suburban, and rural communities around the nation to strengthen and promote “one-call” information centers and other tools that conveniently “connect the dots.”

National Relevance of the Research:

One-Call, One-Click projects have been initiated and supported nationally to help not only veterans but all rural and targeted populations who are in need of transportation to and from jobs, medical services, and recreational activities. Research into these communities in their unique environments is critical to understanding how best to launch these trip-planning tools and spread the word about their utility. Projects under this objective will address the first mile/last mile gap by looking at innovative ways (such as on-demand transit) to deliver improved transit access.

Relevance to the Transit Industry and Community:

By understanding the transportation needs and interests of the local veterans’ community, it is able to create a better trip planning tool that makes local transit options more accessible to veterans and their families, thereby encouraging them to use those transit options more frequently.

Expected Final Products and Delivery Dates:

- A report on the most promising solutions for One-Call, One-Click Centers by June 30, 2016.

FTA Funding: \$3,189,744

Non-FTA Funding: \$0

Title: *Mobility Services for All Americans (MSAA)*

Grantee: State Departments of Transportation of and Transit Authorities as Direct Recipients

Project Purpose:

The purpose of MSAA is to increase mobility and transportation accessibility and to engage in the deployment planning and preparation of coordinated Human Service Transportation (HST) systems that use Intelligent Transportation Systems (ITS) capabilities. MSAA is targeted for communities of any size or definition and includes public entities currently establishing, operating, coordinating, or brokering general public and HST, including public transit agencies, state/local government departments of transportation, health and human service agencies, federally recognized Indian tribes, and metropolitan planning organizations (MPOs) in the U.S. MSAA is funded through the U.S. DOT Joint Program Office (JPO) by \$750,000 in FY2014 and FY2015. It provides the opportunity to design a replicable, scalable, and interoperable Travel Management Coordination Center (TMCC), and it allows agencies to use a coordinated system to easily book rides and transfers for customers across service areas, improving the customer experience and minimizing duplication. The project will build upon a centralized data exchange capability that allows multiple providers to share information about availability, capacity, rider needs, and useful data such as real-time vehicle locations and schedules.

National Relevance of the Research:

This project enhances accessibility and mobility for persons who are transportation disadvantaged. The MSAA initiative focuses on applying ITS solutions to advance human service transportation delivery.

Relevance to the Transit Industry and Community:

This project showcases promising technologies and practices that improve travel planning and coordination for people who need specialized transportation. It will help the transit community by providing vital services for veterans, older adults, people with disabilities, and others who rely on community transportation providers to access everyday needs such as employment, medical care, and groceries.

Expected Final Products and Delivery Dates:

- Final report to FTA in December 2017.

FTA Funding: \$561,725

Non-FTA Funding: All project sponsors are contributing the 20 percent match.

Title: *Evaluation of Integrated Corridor Management (ICM) Transit Vehicle Data*

Grantee: Volpe National Transportation Systems Center

Project Purpose:

This project conducted an independent evaluation of the Dallas ICM Transit Vehicle Real-Time Data Demonstration, specifically, a case study of the process of acquiring, integrating, and using real-time transit data for Dallas Area Rapid Transit (DART) light rail transit (LRT) vehicles, sharing lessons learned, and demonstrating qualitative evidence for changes in DART's Train Control Center operations due to real-time information. The case study also addressed the impact to ICM operations due to a participating transit agency having limited options to respond in real-time with changes to its operations during the peak periods. Additionally, the case study documented the constraints facing DART to make additional real-time adjustments and, to the degree possible, provide rough order-of-magnitude estimates of the costs necessary to mitigate these constraints.

National Relevance of the Research:

ICM depends on the acquisition of data about current conditions in the corridor, the capability to implement various management strategies (e.g., adding transit capacity in real time to accommodate dynamic mode shift to transit as a result of a major freeway accident), and the modeling tools to support the evaluation and selection of strategies appropriate to the current conditions. Most transit agencies lack the capability to access transit vehicle data in a timely manner to support ICM operations, particularly dynamic mode shift to transit. This project will explore and assess the utility of real-time transit vehicle data (i.e., transit vehicle location and passenger counts), examine the issues, challenges, and feasibility of its use, and provide recommended solutions.

Relevance to the Transit Industry and Community:

ICM is the collective management of transportation networks (e.g., freeways, arterials, rail and bus routes, and parking facilities) in a corridor. This project will help transit agencies participate more actively in operating and managing metropolitan corridors as a system with other transportation agency partners (e.g., state departments of transportation, cities, and toll authorities). The project identified transit issues and constraints to be addressed.

Expected Final Products and Delivery Dates:

A project briefing on results to date was presented in September 2014 at the ITS World Congress, at the American Public Transportation Association (APTA) Rail Conference in June 2015, and at U.S. DOT in November 2015. Final report was submitted to FTA in December 2014.

FTA Funding: \$100,000

Non-FTA Funding: \$77,846 from Omnibus Appropriations Bill (P.L. 111-117) under the Office of the Secretary of Transportation (OST) account “Transportation Planning, Research and Development (TPR&D).”

Promoting Asset Innovation and Asset Management

Objective:

This program directly addresses the U.S. DOT environmental sustainability strategy to promote the development and deployment of technologies to reduce the energy consumption and greenhouse gas (GHG) emissions of transit systems. FTA will undertake research on zero-emission vehicles, facilities, and technologies research and will identify innovative and sustainable uses of transit vehicles and services. FTA also expects to invest in projects that study how life-cycle costs impact asset investment decisions.

Description:

FTA has a long history of researching and demonstrating advanced bus technologies. MAP-21 continued this by creating a stand-alone deployment program for low- and no-emission vehicles. The electric vehicle market is still in its infancy; electric transit vehicles are only a small part of the marketplace, but they could significantly change the entire cost calculation for operating transit. Inductive charging technology offers the promise to radically change the range of running vehicles that normally would require heavy batteries and long layovers. This effort, combined with FTA's goals for state of good repair and its requirements for asset management plans, requires both industry and operators to think strategically about asset management and asset innovation.

List of Projects: (9)

1. *Zero Emission Bus Research*
2. *Bus Market Study*
3. *Zero-Emission Bus Evaluation and Support*
4. *Low or No Emission Vehicle Deployment Program (LoNo Program)*
5. *Bus Efficiency Enhancements Research and Demonstrations (BEERD) Program*
6. *U.S.–China Zero Emissions Bus Collaboration*
7. *Fuel Cell Bus Evaluation and Support*
8. *Transit Conditions and Performance*
9. *Small Business Innovation Research (SBIR) Program*

Outputs:

- Research, develop, and deploy zero-emission transit vehicles, facilities, and technologies;
- Identify innovative and sustainable use of transit vehicles and services through practices and technologies; and
- Develop partnerships with other federal agencies involved in energy and environmental research.

Outcome/Impact:

To identify innovative and sustainable uses of transit vehicles and services to reduce the energy consumption and greenhouse gas (GHG) emissions of transit systems.

Approved Projects for 2015:

In July 2015, the following projects were approved. FTA is finalizing Statements of Work (SOW) and implementation strategies for these projects, and funding will be obligated in FY 2016.

Title: Zero Emission Bus Research

Grantee: various

Project Purpose:

The purpose of the zero emission bus research program is to support the research, development and deployment of zero emission technology for transit buses. With FY15 approved funding of \$2.5 million, FTA is planning to address the following critical research needs with respect to zero emission bus: develop integration and deployment tools, define safety risks of lithium-ion batteries, model electricity requirements, research into reducing costs and increasing component durability, and supporting the validation of more standardized bus charging systems.

National Relevance of the Research:

FTA has been involved for over 20 years in transit bus research focusing on increasingly cleaner and more energy efficient propulsion systems. It currently supports over \$100 million in existing bus technology demonstration and deployment projects through various programs, such as the National Fuel Cell Bus Program (NFCBP) and the Low or No (LoNo) Emission Vehicle Deployment Program. The collected outcomes resulting from this zero emission bus research effort will enable FTA to make informed decisions in future research needs and priorities related to zero emission bus technology and applications.

Relevance to the Transit Industry and Community:

The results from this zero emission bus research effort will advance the commercialization of zero-emission bus technology, and make it less expensive

and risky for transit agencies to procure and operate zero-emission buses, enable transit agencies to make informed procurement and operational decisions whether, when and how to invest in zero emission bus fleet and subsequent deployment strategies, and ultimately benefit the traveling public and communities across the nation.

Expected Final Products and Delivery Dates:

- Documentation of status and forecasted changes in commercially viable zero-emission bus technology
- Research or evaluation reports of advanced bus technology components
- Studies and analyses of topics relevant to energy efficiency and bus technology
- Technical and strategic planning related assignments as requested

FTA Funding: \$2,500,000

Non-FTA Funding: \$0

Title: *Transit Bus Market Study*

Grantee: Volpe National Transportation Systems Center (intended)

Project Purpose:

This project will include a literature survey, interviews, and other applicable market research to identify critical attributes of transit buses in the legacy fleet, in current orders, and anticipated in the future. Examples of such attributes may include the following:

- What vehicle types and technologies currently serve notable niche markets?
- What vehicle types and technologies do we expect to dominate – or share – the transit marketplace in the future?
- What vehicle types and technologies do we expect to fill significant niches in the future transit marketplace?
- What foreseeable emerging and/or disruptive vehicle types and/or technologies will impact the current transit bus market?
- What are challenges being experienced by bus manufactures bringing new product(s) to market?
- How do current FTA laws, practices, policies or guidance inhibit introduction of new technologies and buses into the marketplace?

National Relevance of the Research:

The project will better inform FTA investments in transit bus research, development, and deployment with adequate supporting data about the status and projected trends of the industry and technologies. While electric-drive buses continue to become more common and perhaps even dominant in the future,

it remains uncertain how and the extent to which the currently-low costs of diesel fuel and natural gas and the technological improvements observed in these conventional bus technologies will affect such transition.

Relevance to the Transit Industry and Community:

The transit bus industry is in a period of accelerated innovation unlike any that has been seen in the careers of current transit professionals. Diesel-powered transit buses are now on the order of 90 to 99 percent cleaner than they were decades ago due to the development of enhanced emissions control technologies. Natural gas has become substantially less expensive than in the past due to the development of hydraulic fracturing extraction technologies. As their performance has improved and costs have come down, battery-electric and fuel cell buses are being used in daily transit service at a few pioneering transit agencies, and are poised to become much more widely utilized in the future.

Expected Final Products and Delivery Dates:

- Content (text and graphics) for an electronically-published report on the status and future trends of the transit bus industry and technologies. This report will be structured to facilitate continuous or periodic updating by the original or other performer if follow-on funding is available.

FTA Funding: \$250,000

Non-FTA Funding: \$0

Title: *Zero-Emission Bus Evaluation and Support*

Grantee: U.S. Department of Energy (DOE), National Renewable Energy Laboratory (NREL), Golden, CO

Project Purpose:

This project consists of an Interagency Agreement to the DOE's National Renewable Energy Lab (NREL) to support evaluation of new technology buses. This project evaluates zero-emission bus technologies in transit and coordinates information and data-sharing among demonstration efforts. NREL evaluates zero-emission bus demonstration and deployment efforts and selected low-emission bus demonstration efforts, funded by the LoNo program, the National Fuel Cell Bus Program, and the TIGER program, to determine the status of these technologies and provide lessons learned to aid other fleets in implementing the next generation of zero-emission buses into transit operations.

National Relevance of the Research:

Independent, consistent evaluation of new technology demonstration efforts is essential to understanding the outcomes of federal research investments. The evaluation also provides input to identifying additional research needs necessary for successful commercialization of zero-emission buses.

Relevance to the Transit Industry and Community:

Independent evaluation provides meaningful information to the industry on expected benefits and costs related to implementing new technologies for their fleets. Information from the evaluations aid the transit industry in determining which technologies to implement and which investments in transit technologies may be beneficial for their operations.

Expected Final Products and Delivery Dates:

Analysis and publication of data of program-wide impacts and outcomes of individual bus evaluation efforts and reports detailing evaluation project and evaluation efforts is ongoing.

FTA Funding: \$900,000

Non-FTA Funding: \$225,000 from California Air Resources Board to evaluate advanced technology buses. Project is additionally leveraged and coordinated with DOE evaluation activities.

Assistance Received in 2015:

The following projects were started and obligated in FY 2015 from money appropriated in previous years. FTA finalized SOW's, implemented strategies for these projects, and obligated them in 2015.

Title: Low or No Emission Vehicle Deployment Program (LoNo Program)

Grantee: Transit Agencies

Project teams comprised of transit agencies and bus manufacturers to deploy clean technology buses that are largely proven in testing and demonstrations but not widely deployed in transit fleets.

Project Purpose:

The purpose of this project is to lower the cost and increase the quality and availability of cleaner buses, increase private investment in cutting-edge U.S. transit bus development, and increase the number and qualifications of people involved in U.S. bus design and manufacturing. FTA's LoNo Program aims to advance deployment of the cleanest and most energy-efficient U.S.-made transit buses. The program targets bus models largely proven in testing and demonstrations but are not yet widely deployed in transit fleets. The LoNo Program provides funding for transit agencies for capital acquisitions and leases of zero-emission and low-emission transit buses, including acquisition, construction, and leasing of required supporting facilities such as recharging, refueling, and maintenance facilities.

National Relevance of the Research:

These competitively-selected projects will implement a provision of MAP-21 (49 U.S.C. 5312[d][5]) authorizing the LoNo Program. National applicability, including whether the proposed project could be replicated by other transit agencies regionally or nationally, is a specific proposal evaluation criterion for selecting among proposals. Applications are limited to those from an eligible area designated as a non-attainment area for ozone or carbon monoxide under section 107(d) of the Clean Air Act (42 U.S.C. 7407[d]) or a maintenance area, as defined in Section 5303, for ozone or carbon monoxide. Many transit agencies nationwide are located in either a non-attainment area or a maintenance area. This program will result in lower cost and increased availability of cleaner buses, more private investment in transit bus development, and new jobs in U.S. transit bus design and manufacturing. A table of the selected projects can be found in the Appendix 3.

Relevance to the Transit Industry and Community:

The results of these projects will enable transit agencies to incorporate lessons learned from the initial deployment of low or no emission buses into their future plans for bus procurements and to lower cost improve quality and increase availability of cleaner buses.

Expected Final Products and Delivery Dates:

Data on emissions, energy use, operational performance, and maintenance requirements of LoNo buses—10 fuel cell buses, 33 battery-electric buses, 17 series-electric hybrid buses—in 2017–18.

FTA Funding: FY 2013-2015 appropriations: of \$76.9 million with FY 2015 Appropriations of \$22 million are expected to be allocated in summer 2016.

Non-FTA Funding: Projects sponsors will provide the required match of at least 15 percent of the cost of all transit bus acquisitions and 10% of cost for all related equipment and facilities.

Title: *Bus Efficiency Enhancements Research and Demonstrations (BEERD) Program*

Grantee: Departments of Transportation, Transit Agencies, and Instrumentalities of the Government, Including Federal Laboratories

Project Purpose:

The purpose of the program is to promote the development and demonstration of targeted energy efficiency-enhancing technologies—specifically enhanced Electrification of Accessories and improvements in Thermal Management of Bus Bodies—for buses utilized in public transportation. In addition to reducing energy use by transit buses, projects funded can have favorable impacts on meeting the

needs of the riding public, public transportation operators, and the American bus industry and its supplier base, while simultaneously advancing the Department's research goals, which include but are not limited to improving safety, enhancing the state of good repair of transit systems, providing more effective and efficient public transportation service, increasing capital and operating efficiencies, developing and deploying advanced vehicle designs and technology, reducing harmful emissions, and increasing energy efficiency. A table of the selected projects can be found in the Appendix 4.

National Relevance of the Research:

This program supports an overarching FTA goal of developing and deploying new and innovative ideas, practices, and approaches for transit buses.

Relevance to the Transit Industry and Community:

This program invests in promising technologies that could help save energy, reduce emissions, and bring cost-savings to transit providers across the country.

Expected Final Products and Delivery Dates:

New technologies to FTA in 2017.

FTA Funding: \$3,995,098

Non-FTA Funding: Project sponsors provide the required match.

Title: *U.S.–China Zero Emissions Bus Collaboration*

Grantee: CALSTART, Inc.

Project Purpose:

This program will build upon the efforts of the National Fuel Cell Bus Program, the new Low or No Emission Vehicle Deployment Program, and CALSTART's zero-emission bus programs to fully develop and design the Race to Zero Emissions initiative by engaging key stakeholders in both countries and conducting outreach and education activities to provide the most effective and far-reaching benefits to the vehicle industry, transit agencies and communities.

National Relevance of the Research:

The Race to Zero Emissions is a new initiative to foster enhanced bilateral efforts between the U.S. and China to reduce GHG emissions in the heavy-duty vehicle sector. The initiative provides a framework for cooperation between the world's two largest GHG-emitting countries and provides an opportunity for shared economic benefits.

Relevance to the Transit Industry and Community:

Communities within China and the U.S. will be designated to participate, with successful teams achieving a specified percentage of their transit bus fleet powered by zero-emission technologies. Any bus technology that achieves zero tailpipe emission will be eligible, including battery electric buses and fuel-cell-powered buses. In addition to enormous benefits for these highlighted communities in realizing a significant zero-emission milestone, all communities in China and the U.S. could benefit from accelerated commercialization of zero-emission buses and related technologies and focused national attention on zero-emission transit. Zero-emission buses can provide superior, clean, quiet transportation options for communities, help improve the local air quality, and significantly reduce GHG emissions.

Expected Final Products and Delivery Dates:

Final deliverable will occur when transit operators in both the U.S. and China become participants in the Race to Zero Emissions program. The outcome will be an international network designed to bolster and support greater deployment of buses that significantly reduce GHG emissions. This is an indefinite endeavor with a goal to officially kick off the program in 2016.

FTA Funding: FY 2013-FY2015 \$500,000

Non-FTA Funding: \$0

Ongoing Projects for 2015:

The following projects were still active in 2015 but funded in previous years.

Title: Fuel Cell Bus Evaluation and Support

Grantee: U.S. DOE, NREL, Golden, CO

Project Purpose:

NREL assists FTA in implementing clean energy research projects by providing unbiased, expert technical input in analysis and assessment of demonstration projects. NREL analyzes data collected from National Fuel Cell Bus Program (NFCBP) demonstration projects, develops interim and final reports on individual project for publication, and provides consultation on evaluation procedures.

National Relevance of the Research:

FTA's primary clean energy research program has been the NFCBP, a \$90-million, multi-year, cost-shared research program for developing and demonstrating commercially-viable fuel cell technology for transit buses. NREL provides unbiased evaluations to assess the success of the individual fuel cell bus projects and the overall program.

Relevance to the Transit Industry and Community:

As fuel cells and other zero-emission technologies move closer to commercialization and are adopted by transit agencies in increasing numbers, unbiased information on their costs and performance is essential. NREL's analysis and reports on zero-emission technologies provide valuable insight into the commercial readiness of these technologies and their performance in the rigors of transit service. Evaluation efforts are coordinated with DOE hydrogen vehicle research program efforts through a joint evaluation plan.

Expected Final Products and Delivery Dates:

- Products include analyses of NFCBP projects and evaluations of nationally-significant fuel cell bus projects.
- Support for evaluating buses from NFCBP continues under related agreement that incorporates evaluation of the buses funded through the MAP-21 LoNo Program.

FTA Funding: \$1,125,000

Non-FTA Funding: \$0

Title: *Transit Conditions and Performance*

Grantee: Booz Allen Hamilton Inc.

Project Purpose:

The purpose of this project is to provide a report quantifying the conditions and performance of the transit industry in the U.S. and to develop and maintain the Transit Economic Requirements Model (TERM) to support infrastructure investment needs analysis. TERM is a PC-based computer application designed to estimate the nation's transit capital investment needs over an extended horizon. The model estimates the total amount of annual capital expenditures required over a 20-year period to maintain or improve the physical condition and performance of the nation's transit infrastructure. The results are combined with those produced by FHWA into a biennial report to Congress on the status of the nation's highways, bridges, and transit systems.

National Relevance of the Research:

The report provides general investment benchmarks as a basis for the development and evaluation of transit policy and program options. It enhances understanding of the conditions, performance, and reinvestment needs of U.S. transit systems. The analysis is supported by an extensive inventory of all transit assets in the U.S.; the data included in the inventory are provided by transit agencies and are periodically updated to reflect the current state of the national inventory.

Relevance to the Transit Industry and Community:

TERM-Lite, which this work supports, is widely used by transit agencies for projecting their long-term capital investment needs. TERM-Lite estimates the total amount of annual capital expenditures required over a 20-year period to maintain, achieve a State of Good Repair, and improve the physical condition and performance of the agency's transit infrastructure. TERM-Lite allows agencies to control a wide range of model input parameters to facilitate the analysis of a wide range of investment scenarios.

Expected Final Products and Delivery Dates:

"2015 Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance" (report to Congress) to be released in April 2016.

FTA Funding: \$3,171,333

Non-FTA Funding: \$0

Title: *Small Business Innovation Research (SBIR) Program*

Grantee: Volpe National Transportation Systems Center

Project Purpose:

This program continues support of the Small Business Innovation Research (SBIR) program as implemented by U.S. DOT. Through this program, FTA contributes an amount of funds, consistent with statutory requirements, for projects related to its research needs that also enhance the international competitiveness and innovative capabilities of small business in the U.S. FTA funding for SBIR is made available through Intra-Agency Agreements with Volpe. For FY2016, the take down is 3 percent of the extramural research and development (R&D) budget.

National Relevance of the Research:

This program supports small businesses to develop and commercialize innovations in the U.S.

Relevance to the Transit Industry and Community:

FTA SBIR Program supports innovations in public transit. Statutory requirements and the program are authorized until 2017.

Expected Final Products and Delivery Dates:

- Successful Phase I grantees have the option to propose a Phase II project for funding
- Final project report is required for each grantee when their project is complete.

FTA Funding: \$2,708,795

Non-FTA Funding: \$0

FY 2016 Budget: Proposed Allocation of Appropriated Funds

FY 2016 Appropriations—Innovative Public Transportation Projects (Section 5312)—\$28 Million

To build on these accomplishments and in accordance with the Fixing America’s Surface Transportation (FAST) Act, Congress provided \$28 million in FY 2016 for Public Transportation Innovation which fund research; innovation and development; demonstrations, deployment and evaluation; assessing low and no emission vehicle components; and the Transit Cooperative Research Program. FY2016 projects will be chosen through a new transparent, participatory, and consensus oriented planning process. Later, in 2016, given that there is a five year authorization, FTA will develop a five year strategic plan. In the future, FTA intends to catapult future research activities by the combination of the 2016 tactical project planning process, the pipeline phased approach of public transportation innovation research, and the development of the new five year upcoming strategic plan. This process leverages the flexibility and discovery nature of research and the importance of broad stakeholder engagement to stay abreast of critical industry research needs. Often early project expectations shift and move as the rigor of research unfolds. Trends change over time. The result is always a series of successes, sometimes failures, and often unexpected outcomes, but always yields innovation and learning.

Table 5

Pipeline Phased Approach of Public Transportation Innovation Research



\$20 million – Research, Innovation, Development, Demonstration, and Deployment Projects

FTA will award contracts and cooperative through research, development, demonstration, and deployment projects, and evaluation of research and technology of national significance to public transportation that improves public transportation in our nation.

Research – Section 5312(c)

The FY 2016 Research, Development, Demonstration, and Deployment request will support activities that improve providing more effective and efficient public transportation service. Possible areas of research including services that enhance transportation options for seniors; individuals with disabilities; and low-income individuals and new tools for mobility management and travel management systems. Based upon the results of the FY2016 tactical planning process, other research may focus upon:

- data and communication system advancements;
- system capacity, including—
 - train control;
 - capacity improvements; and
 - performance management;
- capital and operating efficiencies;
- planning and forecasting modeling and simulation;
- advanced vehicle design;
- advancements in vehicle technology;
- asset maintenance and repair systems advancement;
- construction and project management;
- alternative fuels;
- the environment and energy efficiency;
- safety improvements.

Innovation and Development – Section 5312(d)

Consistent with the phased pipeline process, FTA will build upon previous research to carry out public transportation innovation and development project that improve public transportation systems nationwide in order to provide more efficient and effective delivery of public transportation services, including through technology and technological capacity improvements. The Mobility on Demand initiative is an emerging and expanding area of investment in this area, and FTA will continue projects that advance:

- planning and forecasting modeling and simulation;
- capital and operating efficiencies;
- advanced vehicle design;
- advancements in vehicle technology;
- the environment and energy efficiency;
- system capacity, including train control and capacity improvements.

Demonstration, Deployment and Evaluation – Section 5312 (e)

FTA will continue to put the majority of its research investments to demonstrate and deploy, projects that promote the early deployment and demonstration of innovations in public transportation that has broad applicability to the industry. These projects will build upon successful research, innovation, and development efforts to achieve the following statutory requirements:

- facilitate the deployment of research and technology development resulting from private or Federally funded efforts;
- the implementation of research and technology development to advance the interests of public transportation.; or
- the deployment of low or no emission vehicles, zero emission vehicles, or associated advanced technology.

Key projects associated with safety and asset management/innovation such as those noted in Appendix 2, 3, and 4 will continue, and new projects in the area of mobility will be funded based upon the results of FTA's new transparent, participatory, and consensus oriented planning process. FTA's continued challenge for all of its projects will be the statutorily required 20 percent match; while possible to require project sponsors in demonstrations and deployments, this continues to limit the amount of research and innovation and development projects FTA can do, particularly with the other governmental entities with which it works.

\$3 million – Assessing Low or No Emission Vehicle Components – Section 5312 (h)

Section 5312 of Title 49 U.S.C, as amended by the FAST Act requires the FTA to establish a testing program to assess low or no emission vehicle (LoNo) components. A higher education organization(s) will be competitively selected to operate and maintain a facility to test, evaluate, and analyze LoNo vehicle components. The chosen institution will be able to establish and collect fees for these activities to provide 50 percent match to the 50 percent of funds provided by FTA. Additionally, two years from the date of the FAST Act, FTA will report on low or no emission vehicle component assessments conducted at each facility conducting LoNo assessments including information related to the maintainability, reliability, performance, structural integrity, efficiency, and noise of those low or no emission vehicle components.

\$5 million – Transit Cooperative Research Program

The FY 2016 Transit Cooperative Research Program (TCRP) will continue as a cooperative agreement through the National Academy of Sciences to carry out activities to support FTA's public transportation innovation projects, especially relating to ensuring research to practice and projects recommended by an independent governing board. This independent board has a critical

role to suggest public transportation research, development, and technology transfer activities that further the effectiveness, efficiency, and quality of public transportation. TCRP is vital to continuing to offer practical short-term research directly to transit practitioners to assist in the efficient and effective delivery of public transportation service.

Why Do We Want/Need to Fund the Program at the Requested Level?

This total \$ 28 million request will support FTA's mission by providing public transportation innovation projects in safety, asset management/innovation, and mobility that enhance public transportation through projects of national significance. In the future, FTA will need general fund allocations (up to \$20 million is authorized annually from the General Fund) in order to continue to manage projects through the pipeline phased process given the limitations of what can be funded under the Mass Transit Account of the Highway Trust Fund. As an example, the yearly Trust Fund authorization is only 21 percent of the 2015 total research activities portfolio.

How Do We Know The Program Works?

FTA's support to the industry consists primarily of capital and operating assistance. However, research is needed to:

- improve the delivery of efficient transit service that is safe;
- ensure expanded mobility for persons with disabilities, seniors, and low income populations;
- support effective asset management; and innovate to ensure environmentally sound LoNo vehicles.

As the primary source of public transportation assistance in the U.S., FTA and its cooperative agreement research partners funded by Section 5312, are in a unique position to lead the industry to address emerging trends, overcome challenges, and support FTA's priority areas. Over the years, a pipeline of projects were created from a phased approach building upon foundational research, innovation ideas and public transportation solutions development with well-funded locally based demonstration and deployment projects. These demonstrations have piloted new technologies such as hybrid vehicles and electronic fare cards that are now used in most transit agencies. FTA support in areas such as electric vehicles and safety technology continues to drive new innovation at the local and regional levels.

Research funded through the Transit Cooperative Research Program has provided individual transit agencies with easy access to the combined knowledge and practices of the broader transit industry. This access has enabled decision-makers to learn from best practices and experiences to improve operating

efficiencies, better leverage existing resources, and produce a stronger return on their investments.

What Benefits Will Be Provided to the American Public through this Request?

The findings of FTA's research, innovation and demonstration programs benefit riders, providers, and all members living in communities with public transit services. New safety technologies and solutions that public transit agencies can implement will mitigate injuries and fatalities. New, more energy efficient capital will continue to reduce harmful emissions and reduce energy costs. Advancements in mobility through shared public and private services mean more people can get a ride when and where they need it. Operational processes that track important data for transit agency operational efficiency reduce provider costs. Innovations in capital stimulate the economy and boost private sector businesses. FTA's small business innovation program provides seed funding to launch entrepreneurial initiatives and create new jobs. The major benefits of public transportation innovative research is that FTA works to stay ahead of trends and ensure the long-term viability of public transit systems that constantly improve service to travelers and stimulate social, economic, environmental, and financial benefits for all transportation stakeholders.

Summary of FTA 2015 Research Accomplishments

FTA's 2015 research activities are driving the development of many useful resources for the industry. Innovative research and demonstration grants are in process with impending recommendations for technologies that hold great promise to improve public transportation systems and travel. Projects are assessing new operational processes, piloting more efficient ways to schedule a ride, testing systems for monitoring rider and passenger safety, funding innovative improvement to buses that reduce emissions and energy use, and demonstrating and deploying real-world solutions across the three priorities of safety, asset management/innovation, and mobility. The following are some highlights from FTA's 2015 research activities.

Safety projects are identifying key issues and seeking practical solutions that reduce traffic injuries and fatalities. Areas of inquiry are safety data collection, safety standards, guidance, close call reporting, and FTA is working with 13 grantees across nine states to advance: operational safety, infrastructure or equipment resiliency, and all-hazards emergency response and recovery methods. Ongoing demonstration projects are also reviewing the technical merits and feasibility of vehicle assist automation (VAA) technology applications and the commensurate return on investment on bus revenue service. Caltrans, partnering with AC Transit and Lane Transit District, demonstrated VAA applications of bus lateral control in a transitway and precision docking at bus stops using magnetic marker sensing technology.

The expanding field of mobility research continues a fast-paced trajectory to help agencies harness both public and private assets to improve the traveler's experience and, hence, underscore the utility of a robust, integrated, and shared public transportation network. Mobility projects consist of a diverse portfolio of activities from harnessing thought leadership in the academic community around wellness and transportation to developing tools for the collective management of transportation networks. Ubiquitous 24/7 social networking tools and transportation networks are being explored with public transportation systems to see how these services can be shared and mutual benefit achieved. Issues such as data sharing, proprietary technology, accessibility are being targeted for further understanding. Through research that encourages the development of complementary and supplemental mobility options, FTA is learning more about ways to improve multi-modal connectivity and how to pave the way for connected and autonomous vehicles. Service geography and hours of coverage that public transportation providers thought was not affordable is becoming possible through private sector partnerships. Patients who receive dialysis treatment can get access to a real-time ride, rather than have to make an appointment when they are unsure of when they will feel well enough to go home. Doctors and large insurers are finding that transportation partners can help them reduce cost and improve service to their clients. Mobility initiatives that improve the efficiency and effectiveness of community transportation options are increasing the quality and accessibility of transportation options for everyone.

FTA funded a study on integrated corridor management (ICM) to see how well one of the solutions being implemented in Dallas at DART is monitoring and enabling real-time changes that help them respond to peak periods on freeways, arterials, rail and bus routes, and parking facilities. The case study documented the constraints facing DART to make additional real-time adjustments and, to the degree possible, provided rough order-of-magnitude estimates of the costs necessary to mitigate these constraints. FTA's strategic emphasis on mobility spans a focus on the person, the provider, and the system.

Asset management and asset innovation address a long-standing environmental and sustainability strategy to undertake research on zero-emission vehicles, facilities, technologies, and identify innovative and sustainable uses of transit vehicles and services. Private sector partnerships and collaboration with other federal agencies involved in energy and environmental research is a large part of asset management projects. The statutorily required and, flagship program, low or no emissions vehicle (LoNo), funds extensive demonstration grants with teams comprised of transit agencies and bus manufacturers to deploy clean technology buses. LoNo activities are lowering the cost, increasing the quality, and the availability of cleaner buses, as well as expanding private investment in cutting-edge U.S. transit bus development. There are benefits to jobs, as LoNo projects increase the number and qualifications of people involved in U.S. bus design

and manufacturing. The LoNo Program provides funding for transit agencies for capital acquisitions and leases of zero-emission and low-emission transit buses, including acquisition, construction, and leasing of required supporting facilities such as recharging, refueling, and maintenance facilities. Another major demonstration grant extending bus efficiency is the Bus Efficiency Enhancements Research and Demonstrations (BEERD) Program. BEERD grantees are developing and demonstrating enhanced Electrification of Accessories and improvements in Thermal Management of Bus Bodies—for buses utilized in public transportation. In addition to reducing energy use by transit buses, projects funded can have favorable impacts on meeting the needs of the riding public, public transportation operators, and the American bus industry and its supplier base.

Asset management projects are quantifying the conditions and performance of the transit industry in the U.S. to create and maintain a model called the Transit Economic Requirements Model (TERM) to support infrastructure investment needs analysis. TERM is a PC-based computer application designed to estimate the nation's transit capital investment needs over an extended horizon. The model estimates the total amount of annual capital expenditures required over a 20-year period to maintain or improve the physical condition and performance of the nation's transit infrastructure.

Whether developing processes for capital asset management or furthering low or no emissions, FTA asset management and innovation research tries to stay on the cutting edge of new developments that improve public transportation capital investments. As technologies like fuel cells and other zero-emission technologies move closer to commercialization and are adopted by transit agencies in increasing numbers, FTA is overseeing evaluations to gather unbiased information on their costs and performance. One of the reports released provided valuable insight into the commercial readiness of these technologies and their performance in the rigors of transit service.

FTA's research explores, describes, explains, tests, and evaluates technology across the three priority areas. The nature of science in any discipline is a discovery process to yield results. The challenge of science is that the result may create larger questions. As the detailed descriptions show, many of the projects that were ongoing, begun, and/or planned in 2015 are still in their early stages. Important reports and findings from demonstration grants are forthcoming over the next several years. With the FAST Act now in place, FTA's research office is in an excellent position to leverage this five year direction with a new strategic plan. This plan will show year over year, how FTA's pipeline phased process builds on investments and achieves demonstrable results that either lead to full deployment of innovations or stimulate additional scientific inquiry. FTA looks forward to following up this report with many findings of national significance for public transportation innovation in 2017.

Appendices

Appendix 1

Federal Transit Administration MAP-21 Section 5312 Research Investments

MAP-21 Section 5312 Eligible Project and Priority Area					
Type of Project	Strategic Priority Area	Project Title	Ongoing or Funding Allocated in 2015	Approved in FY2015 Pending Award	Totals
	Safety Total Awards		\$31,800,000	\$3,000,000	\$34,800,000
Research	Safety	Safety Standards Strategic Plan Development and Data Collection Strategy	\$1,500,000	\$0	\$1,500,000
Innovation & Development	Safety	FTA Employee Safety Reporting and Confidential Close Call Reporting Pilot Program	\$0	\$3,000,000	\$3,000,000
Demonstration & Deployment	Safety	Vehicle Assist and Automation (VAA) Demonstration*	\$1,300,000	\$0	\$1,300,000
Demonstration & Deployment	Safety	Innovative Safety, Resiliency, and All-Hazards Emergency Response and Recovery Research Demonstrations (SRER) - A table of the selected projects can be found below	\$29,000,000	\$0	\$29,000,000
	Mobility Total Awards		\$10,259,695	\$2,500,000	\$12,759,695
Innovation & Development	Mobility	Mobility on Demand (MOD) Program	\$2,700,000	\$0	\$2,700,000
Research	Mobility	Accessible Transportation Technologies Research Initiative (ATTRI)	\$0	\$2,500,000	\$2,500,000
Research	Mobility	Ride to Wellness	\$4,000,000	\$0	\$4,000,000
Demonstration & Deployment	Mobility	Veterans Transportation and Community Living Initiative (VTCLI)	\$2,897,970	\$0	\$2,897,970
Demonstration & Deployment	Mobility	Evaluation of Integrated Corridor Management (ICM) Transit Vehicle Data*	\$100,000	\$0	\$100,000
Innovation & Development	Mobility	Mobility Services for All Americans (MSAA)	\$561,725	\$0	\$561,725

Appendix 1 (cont.)*Federal Transit Administration MAP-2I Section 5312 Research Investments*

MAP-2I Section 5312 Eligible Project and Priority Area					
Type of Project	Strategic Priority Area	Project Title	Ongoing or Funding Allocated in 2015	Approved in FY2015 Pending Award	Totals
	Asset Innovation and Asset Management Total Awards		\$61,609,682	\$26,524,936	\$88,134,618
Innovation & Deployment	Asset Innovation and Asset Management	Zero Emission Bus Research	\$0	\$2,500,000	\$2,500,000
Research	Asset Innovation and Asset Management	Bus Market Study	\$0	\$250,000	\$250,000
Research	Asset Innovation and Asset Management	Zero-Emission Bus Evaluation and Support	\$900,000	\$0	\$900,000
Demonstration & Deployment	Asset Innovation and Asset Management	Low or No Emission Vehicle Deployment Program (LoNo) Program – a table of the selected projects can be found below	\$54,469,249	\$22,500,000	\$76,969,249
Demonstration & Deployment	Asset Innovation and Asset Management	Bus Efficiency Enhancements Research and Demonstrations (BEERD) Program	\$2,720,162	\$1,274,936	\$3,995,098
Research	Asset Innovation and Asset Management	U.S.–China Zero Emissions Bus Collaboration	\$500,000	\$0	\$500,000
Research	Asset Innovation and Asset Management	Fuel Cell Bus Evaluation and Support	\$400,000	\$0	\$400,000
Innovation & Development	Asset Innovation and Asset Management	Small Business Innovation Research FY14	\$1,479,670	\$0	\$1,479,670
Innovation & Development	Asset Innovation and Asset Management	Transit Conditions and Performance	\$1,140,601	\$0	\$1,140,601
<i>Totals</i>			<i>\$103,669,377</i>	<i>\$31,974,936</i>	<i>\$135,644,313</i>

Appendix 2

Innovative Safety, Resiliency, and All-Hazards Emergency Response and Recovery Research Demonstrations (SRER) Projects and Grantees

Innovative Safety, Resiliency, and All-Hazards Emergency Response and Recovery Research Demonstrations (SRER)		
Project Title	Project Recipient	FTA Award
Demonstration and Commercialization of a LRV Bumper for Enhanced Safety in Shared Right of Way Street Environments	Applied Research Associates	\$1,323,414
TrackSafe Phase II Demonstration Project	Metropolitan Atlanta Rapid Transit Authority	\$4,233,865
Development of a Bus Exportable Power System for Emergency Response	Center for Transportation and the Environment	\$995,098
Coordinated Transit Response Planning and Operations Support Tools for Mitigating Impacts of All-Hazard Emergency Events	University of Chicago	\$2,890,600
Evacuation and Return: Increasing Safety and Reducing Risk	City of New Orleans	\$500,329
Driver Assist System (DAS) Technology to support Robust, Flexible Bus-on-Shoulder (BOS) and Narrow-Lane Operations for Robust Transit Service	Minnesota Valley Transit Authority	\$1,790,014
New Jersey Transit Critical Infrastructure Storm Surge Warning System (NJT CISSWS)	New Jersey Transit Corporation	\$843,750
Connected Vehicle Infrastructure- Urban Bus Operational Safety Platform	Battelle Memorial Institute	\$2,741,617
Smart, Shared and Social: Enhancing All-Hazards Recovery Plans with Demand Management Technologies	Portland State University	\$943,984
Innovative Platform Track Intrusion Detection System (PTIDS) Technology: A Demonstration on Los Angeles Metro Rail System	Los Angeles County Metropolitan Transportation Authority	\$1,722,400
Resilient Concrete Crosstie and Fastening System Designs for Light Rail, Heavy Rail, and Commuter Rail Transit Infrastructure	University of Illinois	\$2,396,981
Integrated Wheel/Rail Characterization and Safety through Advanced Monitoring and Analytics	New York Metropolitan Transportation Authority	\$3,617,948
	Total	\$24,000,000
Innovative Wayside Safety Technology Demonstration	BART	\$5,000,000*

*pending award

Appendix 3

Low or No Emission Vehicle Deployment Program (LoNo Program) and Grantees

Low or No Emission Vehicle Deployment Program (LoNo Program) Project Title	Grantee	FTA Amount	
		FTA Award	Pending Award
Sunline Transit Agency will deploy 5 Fuel Cell Electric Buses as a follow on to their FTA-supported fuel cell bus demonstration	Southern California Association of Governments		\$9,803,860
SARTA will deploy 5 Fuel Cell Electric Buses	Stark Area Regional Transit Authority	\$8,877,405	
Vehicle replacement and purchase of 17 E-series hybrid Gillig buses	Red Rose Transit Authority	\$2,638,400	
Development and deployment of five 60-foot articulated buses on the MBTA Silver Line Bus Rapid Transit System	Massachusetts Bay Transportation Authority	\$4,139,188	
Deployment of 5 battery electric buses to add to a fleet of 10 electric buses currently in production, and add a fast charging station to expand the service area	Transit Authority of River City (TARC)	\$3,321,250	
RTD will deploy 5 battery electric buses and a charging station to an existing demo of two buses and a charging station	San Joaquin Regional Transit District (RTD)		\$4,702,011
The Duluth Transit Authority will deploy 6 battery electric buses and 3 charging facilities	The Duluth Transit Authority	\$6,343,890	
Dallas Area Rapid Transit will deploy 7 battery electric buses to operate on downtown circulator route, D-Link	Dallas Area Rapid Transit (DART) Authority	\$7,637,111	
Lextran will deploy 5 battery electric buses and a fast charge station at the Lextran Transit Center	Lextran, Transit Authority of the Lexington Fayette Urban County Government	\$6,003,534	
WRTA will install an Electric Bus Fast Charger with Emergency Power Generation for their existing battery-electric buses	Worcester Regional Transit Authority	\$1,002,600	
Total		\$39,963,378	\$14,505,871

Appendix 4

Bus Efficiency Enhancements Research and Demonstrations (BEERD) Program Project and Grantees

Bus Efficiency Enhancements Research and Demonstrations (BEERD) Program Project Title	Grantee	FTA Amount	
		FTA Award	FTA Pending Award
Thermoelectric Generation Demonstration, in partnership with Central Florida Regional Transportation Authority (LYNX)	Center for Transportation and the Environment (CTE)	\$532,258	\$0
Utah Transit Authority (UTA) Paratransit Accessory and Electrification	CTE	\$697,185	\$0
Metropolitan Atlanta Rapid Transit Authority (MARTA), development and demonstration of a BAE Systems prototype Reduced Engine Idle Load System	CTE	\$0	\$1,274,936
Development and demonstration of a retrofit of 35 hybrid buses with a hybrid beltless alternator and support equipment to monitor fuel savings and impact on house batteries	Maryland Transit Administration (MTA)	\$495,621	\$0
Bus Exportable Power System (BEPS) for existing transit buses to export power using their hybrid propulsion systems	CTE	\$995,098	\$0
Total		\$2,720,162	\$1,274,936

Acronyms and Abbreviations

ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
CBTC	Communications-based train control
DAMIS	Drug and Alcohol Management Information System
DOE	Department of Energy
EJ	Environmental Justice
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
GHG	Greenhouse gases
ICM	Integrated Corridor Management
ITS	Intelligent transportation systems
ITWD	Innovative Transit Workforce Development program
MAP-21	Moving Ahead for Progress in the 21st Century Act (Public Law 112-141)
NEPA	National Environmental Policy Act
NREL	National Renewable Energy Laboratory
PTC	Positive train control
R&D	Research and development
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (Public Law 109-59)
SAMIS	Safety Management Information System
SBIR	Small Business Innovation Research
SGR	State of good repair
TERM	Transit Economic Requirements Model
TERP	Transportation Equity Research Program
TIGGER	Transit Investments for Greenhouse Gas and Energy Reduction
TRAC	Transit Research Analysis Committee
TRACS	Transit Rail Advisory Committee for Safety
UTC	University Transportation Center



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