

FTA

FEDERAL TRANSIT ADMINISTRATION

FTA Annual Report on Public Transportation Innovation Research Projects for Fiscal Year 2020

JANUARY 2021

FTA Report No. 0181
Federal Transit Administration

PREPARED BY
Federal Transit Administration



U.S. Department of Transportation
Federal Transit Administration

COVER PHOTO

Courtesy of Edwin Adilson Rodriguez, Federal Transit Administration

DISCLAIMER

This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof. The United States Government does not endorse products of manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the objective of this report.



FTA Annual Report on Public Transportation Innovation Research Projects for Fiscal Year 2020

JANUARY 2021

FTA Report No. 0181

SPONSORED BY

Federal Transit Administration
Office of Research, Demonstration and Innovation
U.S. Department of Transportation
1200 New Jersey Avenue, SE
Washington, DC 20590

AVAILABLE ONLINE

<https://www.transit.dot.gov/about/research-innovation>

Metric Conversion Table

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	liters	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	5 (F-32)/9 or (F-32)/1.8	Celsius	°C

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.
PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE January 2021		2. REPORT TYPE Annual		3. DATES COVERED October 1, 2019–September 30, 2020	
4. TITLE AND SUBTITLE FTA Annual Report on Public Transportation Innovation Research Projects for FY 2020				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Edwin Adilson Rodriguez Office of Research Management, Innovation, and Outreach Federal Transit Administration				5d. PROGRAM NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Federal Transit Administration US Department of Transportation Research, Demonstration and Innovation 1200 New Jersey Ave., SE Washington, DC 20590				8. PERFORMING ORGANIZATION REPORT NUMBER FTA Report No. 0181	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Department of Transportation Federal Transit Administration Office of Research, Demonstration and Innovation 1200 New Jersey Avenue, SE, Washington, DC 20590				10. SPONSOR/MONITOR'S ACRONYM(S) FTA	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Available from: National Technical Information Service (NTIS), Springfield, VA 22161; (703) 605-6000, Fax (703) 605-6900, email [orders@ntis.gov]; Distribution Code TRI-30					
13. SUPPLEMENTARY NOTES [www.transit.dot.gov/about/research-innovation] [https://www.transit.dot.gov/about/research-innovation] [https://doi.org/10.21949/1518353] Suggested citation: Federal Transit Administration. FTA Annual Report on Public Transportation Innovation Research Projects for FY 2020. Washington, D.C.: United States Department of Transportation, 2020. https://doi.org/10.21949/1518353					
14. ABSTRACT This report provides information on projects funded under Federal Public Transportation Law (49 U.S.C. § 5312). FTA research priorities are safety, mobility innovation, and infrastructure. Projects in these areas promote public transportation innovation to improve operations, infrastructure, and traveler experiences. Projects active in FY 2020 promoted research, innovation and development, demonstration and deployment, and evaluation.					
15. SUBJECT TERMS Public transportation, Federal Public Transportation Law, public transportation research, FTA appropriations, FTA research, FTA demonstration and deployment, FTA innovation, FTA evaluation					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Unlimited	18. NUMBER OF PAGES 51	19a. NAME OF RESPONSIBLE PERSON
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified			19b. TELEPHONE NUMBER

Standard Form 298 (Rev. 8/98)
Prescribed by ANSI Std. Z39.18

TABLE OF CONTENTS

1	Executive Summary
5	Requirements for this Report
6	Program and Project Descriptions
6	Safety
7	Innovations in Transit Public Safety Projects
8	Redesign of Transit Bus Operator Compartment to Improve Safety, Operational Efficiency, and Passenger Accessibility (Bus Operator Compartment) Program
9	FY 2020 Safety Research and Demonstration (SRD) Program
10	FY 2020 Safety Research and Demonstration (SRD) Program Evaluation
11	FY 2016 Safety Research and Demonstration (SRD) Program
12	FY 2016 Safety Research and Demonstration (SRD) Program Evaluation
13	Innovative Safety, Resiliency, and All-Hazards Emergency Response and Recovery (SRER) Program
14	FTA Employee Safety Reporting Pilot Program
15	Mobility Innovation
16	Accelerating Innovative Mobility (AIM) Program
18	Integrated Mobility Innovation (IMI) Demonstration Program
20	Mobility on Demand (MOD) Sandbox
21	Mobility on Demand (MOD) Sandbox Evaluation
22	Mobility on Demand (MOD) Metrics and Studies
22	Transit Automation Analysis and Research Plan Development
23	Strategic Transit Automation Research (STAR) Plan Enabling Research and Implementation
24	Transit Bus Automation Strategic Partnerships
24	Accessible Transportation Technologies Research Initiative (ATTRI)
25	Mobility Payment Integration (MPI)
26	Transit and Health Access Initiative
27	Human Services Coordination Research (HSCR) Deployment Program
28	Infrastructure
29	Low or No (LoNo) Emission Component Assessment Program (LoNo-CAP)
30	Low or No (LoNo) Emission Bus Testing Centers
31	Track Asset Management Demonstration
31	Use Cases for Unmanned Aircraft Systems (UAS) in Public Transportation Systems
32	Bus Efficiency Enhancements Research and Demonstration (BEERD) Program
33	Bus Propulsion Evaluation and Support
34	Low or No (LoNo) Emission Vehicle Deployment Program
36	Supporting Programs and Other Initiatives
37	Transit Cooperative Research Program (TCRP)
37	Small Business Innovation Research (SBIR) Program

39	Information Dissemination and Evaluation Program
39	Information Dissemination and Outreach Program
40	Research Evaluation and Implementation Plan
41	Transit Data Research/Secure Data Commons System (SDC)
42	Acronyms and Abbreviations

LIST OF TABLES

2	Table 1: Complete List of FY 2020 Active FTA Research Programs and Projects
7	Table 2: Safety Programs Receiving Assistance from FTA, FY 2020
9	Table 3: Redesign of Transit Bus Operator Compartment to Improve Safety, Operational Efficiency, and Passenger Accessibility (Bus Operator Compartment) Selected Projects
10	Table 4: FY 2020 Safety Research and Demonstration (SRD) Selected Projects
12	Table 5: FY 2016 SRD Projects Receiving Assistance from FTA in FY 2020
14	Table 6: Innovative Safety, Resiliency, and All-Hazards Emergency Response and Recovery (SRER) Research Demonstration Projects Receiving Assistance from FTA, FY 2020
15	Table 7: Mobility Innovation Programs Receiving Assistance from FTA, FY 2020
17	Table 8: Accelerating Innovative Mobility (AIM) Selected Projects
19	Table 9: Integrated Mobility Innovation (IMI) Projects Receiving Assistance from FTA, FY 2020
21	Table 10: Mobility on Demand (MOD) Projects Receiving Assistance from FTA, FY 2020
27	Table 11: Transit and Health Access Projects Receiving Assistance from FTA, FY 2020
28	Table 12: Human Service Coordination Research (HSCR) Projects Receiving Assistance from FTA, FY 2020
29	Table 13: Infrastructure Programs Receiving Assistance from FTA, FY 2020
33	Table 14: Bus Efficiency Enhancements Research and Demonstration (BEERD) Projects Receiving Assistance from FTA, FY 2020
35	Table 15: Low or No (LoNo) Emission Vehicle Deployment Projects Receiving Assistance from FTA, FY 2020
36	Table 16: Supporting Programs and Initiatives Receiving Assistance from FTA, FY 2020
38	Table 17: Small Business Innovation Research (SBIR) Projects Receiving Assistance from FTA, FY 2020

LIST OF FIGURES

1	Figure 1: FTA Pipeline Phased Approach
4	Figure 2: Location of FTA's Research Programs and Projects Recipients



U.S. Department
of Transportation

**Federal Transit
Administration**

Dear Colleague:

I am pleased to provide the Federal Transit Administration (FTA) Annual Report on Research. This report describes public transportation research activities that received assistance under FTA's Public Transportation Innovation Program (49 U.S.C § 5312) during Fiscal Year (FY) 2020. FTA funds research, development, demonstration, deployment, and evaluation projects of national significance that improve public transportation by accelerating innovation that expands peoples' mobility, enhances public transportation operations, and ensures everyone's safety.

This report describes the results of \$196 million, appropriated in multiple years, in research programs and projects active in FY 2020. FTA's research priorities of safety, mobility innovation, and infrastructure are consistent with the Department of Transportation's strategic goals of safety, innovation, and infrastructure. Of the \$196 million, \$44 million is allocated for safety research; \$51 million is allocated for mobility innovation research; \$24 million is allocated for infrastructure research; and \$11 million is allocated for supportive services and other activities such as the \$5 million Transportation Cooperative Research Program. The report also includes \$66 million for the low and no emissions vehicle deployment program that became a separate statutory program in FY 2016.

Among many other research accomplishments over the last year, FTA launched an enhanced focus to accelerate innovation; an expansion of safety for bus operators; and continued providing significant investments to help transit agencies develop and deploy new mobility services.

Thank you for your continued support of public transportation innovation research.

A handwritten signature in blue ink, appearing to read "K. Jane Williams".

K. Jane Williams
Deputy Administrator

EXECUTIVE SUMMARY

Public Transportation Innovation Program (49 U.S.C. § 5312) authorizes the Federal Transit Administration (FTA) to make grants and enter into contracts, cooperative agreements, and other agreements for research, development, demonstration, deployment, and evaluation projects that will improve public transportation.

The mission of FTA is to improve public transportation for America's communities. FTA's research vision is that the United States has a world-class public transportation system with access and mobility for all. FTA's research mission is to advance public transportation by accelerating innovation that improves peoples' mobility, enhances public transportation operations, and ensures everyone's safety.

The FTA's overarching research goals are to improve operations, enhance the travelers' experience, and drive economic growth in America's communities through research in safety, mobility innovation, and infrastructure. Each research program area, consistent with the strategic goals of the U.S. Department of Transportation (DOT), has specific objectives:

- **Safety** – to research new technologies, practices, and designs to improve safety culture, identify hazards and risk, and assess processes that can help transit agencies operate public systems in a safer manner to reduce injuries and fatalities.
- **Mobility Innovation** – to lead in the development and deployment of new technologies and practices that enhance transit operational efficiency, increase mobility and accessibility, and reduce costs. Core objectives in this research are furthering partnerships to increase mobility, research, collaboration, and coordination.
- **Infrastructure** – to stimulate economic growth and evaluate methods, transit assets, service approaches, maintenance strategies, and practices that hold promise to improve lifecycle maintenance as well as system operations and performance.

Research activities evolve through a statutory four-phase research-to-practice pipeline process, as seen in Figure 1, moving from the early research of promising ideas to evaluation and implementation.

Figure 1 FTA Pipeline Phased Approach



- **Research** – developing and deploying new and innovative ideas, practices, and approaches.
- **Innovative Development** – improving public transportation systems nationwide to provide more efficient and effective delivery of public transportation services through technology and technological capacity improvements.
- **Demonstration and Deployment** – enabling early deployment and demonstration of innovations in public transportation with broad applicability, including low or no emission vehicle deployment.
- **Evaluation and Implementation** – analyzing project results and plans for broad-based implementation of research findings.

In FY 2020, FTA actively managed \$196 million in research funding. These funds are from multiple fiscal years and include \$44 million for safety research, \$51 million for mobility innovation research, \$24 million for infrastructure research, and \$11 million for supportive services and other activities such as the \$5 million Transportation Cooperative Research Program. FTA also continued to manage the Low or No (LoNo) Emission Vehicle Deployment Program primarily through FTA regional offices as a capital program. Most of the \$66 million in projects are moving toward closure. In FY 2016, this area became a statutory program called the Low and No Emission Bus Program (49 U.S.C. § 5339(c)). Now, each year, FTA manages the program through competitively-awarded grants.

Table 1 provides a complete list of all FTA research programs and projects that received assistance in FY 2020, with projects categorized by research priority area and type of project. FTA is currently funding research projects in 41 states and the District of Columbia. Figure 2 shows the location of FTA Research programs and projects by DOT research priority area.

Table 1 Complete List of FY 2020 Active FTA Research Programs and Projects

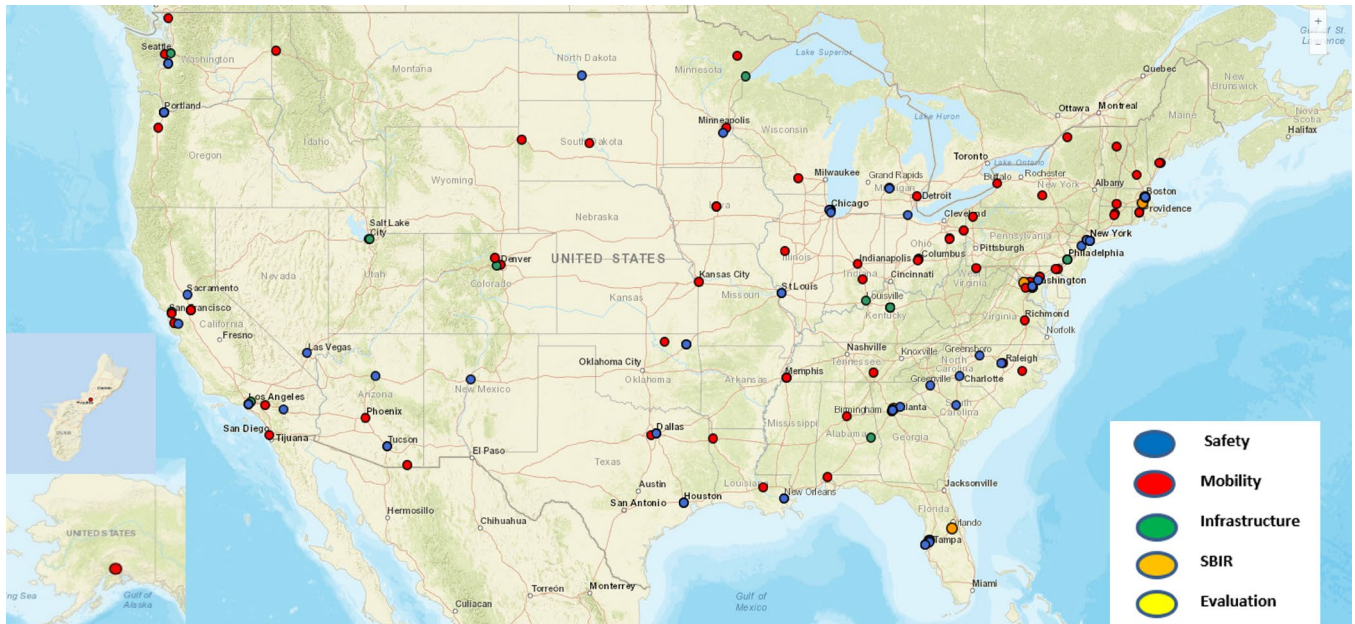
Research Priority	Type of Project	Project Title	FTA Funding
Safety	Demonstration & Deployment	Innovations in Transit Public Safety Projects	\$3,362,874
Safety	Demonstration & Deployment	Redesign of Transit Bus Operator Compartment to Improve Safety, Operational Efficiency, and Passenger Accessibility (Bus Operator Compartment) Program	\$1,600,000
Safety	Demonstration & Deployment	FY 2020 Safety Research and Demonstration (SRD) Program	\$7,513,656
Safety	Evaluation & Implementation	FY 2020 Safety Research and Demonstration (SRD) Program Evaluation	\$700,000
Safety	Demonstration & Deployment	FY 2016 Safety Research and Demonstration (SRD) Program	\$8,516,669
Safety	Evaluation & Implementation	FY 2016 Safety Research and Demonstration (SRD) Program Evaluation	\$750,000

Table 1 (cont'd.) Complete List of FY 2020 Active FTA Research Programs and Projects

Research Priority	Type of Project	Project Title	FTA Funding
Safety	Demonstration & Deployment	Innovative Safety, Resiliency, and All-Hazards Emergency Response and Recovery (SRER) Program	\$18,473,271
Safety	Innovation & Development	FTA Employee Safety Reporting Pilot Program	\$3,000,000
Mobility Innovation	Demonstration & Deployment	Accelerating Innovative Mobility (AIM) Program	\$14,000,000
Mobility Innovation	Demonstration & Deployment	Integrated Mobility Innovation (IMI) Demonstration Program	\$20,035,227
Mobility Innovation	Innovation & Development	Mobility on Demand (MOD) Sandbox	\$6,773,080
Mobility Innovation	Innovation & Development	Mobility on Demand (MOD) Sandbox Evaluation	\$250,000
Mobility Innovation	Innovation & Development	Mobility on Demand (MOD) Metrics and Studies	\$750,000
Mobility Innovation	Research	Transit Automation Analysis and Research Plan Development	\$950,000
Mobility Innovation	Research	Strategic Transit Automation Research (STAR) Plan Enabling Research and Implementation	\$350,000
Mobility Innovation	Research	Transit Bus Automation Strategic Partnerships	\$600,000
Mobility Innovation	Research	Accessible Transportation Technologies Research Initiative (ATTRI)	\$2,500,000
Mobility Innovation	Research	Mobility Payment Integration (MPI)	\$400,000
Mobility Innovation	Research	Transit and Health Access Initiative	\$1,725,130
Mobility Innovation	Demonstration & Deployment	Human Services Coordination Research (HSCR) Deployment Program	\$2,207,857
Infrastructure	Research	Low or No (LoNo) Emission Component Assessment Program	\$13,500,000
Infrastructure	Innovation & Development	Low or No (LoNo) Emission Bus Testing Centers	\$2,000,000
Infrastructure	Demonstration & Deployment	Track Asset Management Demonstration	\$4,225,000
Infrastructure	Research	Use Cases for Unmanned Aircraft Systems (UAS) in Public Transportation Systems	\$140,000
Infrastructure	Demonstration & Deployment	Bus Efficiency Enhancements Research and Demonstrations (BEERD) Program	\$3,000,000
Infrastructure	Research	Bus Propulsion Evaluation and Support	\$1,400,000
Supporting Programs	Research	Transit Cooperative Research Program (TCRP)	\$5,000,000
Supporting Programs	Innovative Development	Small Business Innovation (SBIR)	\$3,222,964
Supporting Programs	Evaluation & Implementation	Information Dissemination and Evaluation Program	\$1,439,692
Supporting Programs	Evaluation & Implementation	Information Dissemination and Outreach Program	\$1,100,000
Supporting Programs	Evaluation & Implementation	Research Evaluation Implementation Plan	\$480,000
Supporting Programs	Evaluation & Implementation	Transit Data Research Project Secure Data Commons System	\$100,000
Total			\$130,065,420
Infrastructure	Demonstration & Deployment	Low or No (LoNo) Emission Vehicle Deployment Program*	<\$65,760,844>
Total			\$195,826,264

*The LoNo Program matured from a research program to a capital discretionary program authorized by Federal public transportation law (49 U.S.C. § 5339(c)). The amount of \$65,760,844 is in brackets to indicate that this program has been broken out separately from the total of actively managed research projects.

Figure 2 Location of FTA Research Programs and Projects Recipients



Requirement for This Report

Federal public transportation law (49 U.S.C. § 5312(f)) requires FTA to post an annual report on research available to the public on its website not later than the first Monday in February of each year. This report should include:

- A description of each project that received assistance under this section during the preceding fiscal year.
- An evaluation of each project that received assistance in the preceding year, including any evaluation conducted for demonstration and deployment projects.

Program and Project Descriptions

This section of the report includes detailed descriptions of programs and projects that received assistance in FY 2020. Definitions of assistance include the planning and development of a new project, the award of a new project, management of an existing project, or evaluation of a project. Program and project descriptions are categorized by research priority area—Safety, Mobility Innovation, and Infrastructure—and conclude with a section on supporting programs and other initiatives. Individual program and project descriptions include title, recipient(s), performance indicators (results), evaluation, and FTA funding.

Safety

Description:

The FTA's Safety research program continued to provide leadership and vision in the development and management of initiatives that seek to improve the safety of passengers, employees, emergency responders, and all others who encounter the public transportation system. FTA continued to support research on technologies and practices that can reduce fatalities and injuries, improve safety culture, identify hazards and risk, and assess processes that can help transit agencies operate public systems in a safer manner to reduce injuries and fatalities.

Objectives:

The FTA Safety research program sought to:

- Operate systems in a safer manner through improved:
 - Application of advanced technologies, practices, and designs
 - Safety culture
 - Human factors
- Reduce injuries and fatalities by using:
 - Innovative technologies to improve worker safety
 - Innovative technologies to improve rider safety

The FTA had eight active Safety projects in FY 2020, as listed in Table 2.

Table 2 Safety Programs Receiving Assistance from FTA, FY 2020

Safety Programs		
Type of Project	Project Title	FTA Funding
Demonstration & Deployment	Innovations in Transit Public Safety Projects	\$3,362,874
Demonstration & Deployment	Redesign of Transit Bus Operator Compartment to Improve Safety, Operational Efficiency, and Passenger Accessibility (Bus Operator Compartment) Program	\$1,600,000
Demonstration & Deployment	FY 2020 Safety Research and Demonstration (SRD) Program	\$7,513,656
Evaluation & Implementation	FY 2020 Safety Research and Demonstration (SRD) Program Evaluation	\$700,000
Demonstration & Deployment	FY 2016 Safety Research and Demonstration (SRD) Program	\$8,516,669
Evaluation & Implementation	FY 2016 Safety Research and Demonstration (SRD) Program Evaluation	\$750,000
Demonstration & Deployment	Innovative Safety, Resiliency, and All-Hazards Emergency Response and Recovery (SRER) Program	\$18,473,271
Innovation & Development	FTA Employee Safety Reporting Pilot Program	\$3,000,000
Total		\$43,916,470

Title: *Innovations in Transit Public Safety Projects*

Recipients: State and local governmental entities, transit authorities, non-profit organizations, or a consortium of entities, including providers of public transportation.

Project Description:

This effort is part of FTA’s Human Trafficking Awareness and Public Safety Initiative and supports DOT’s Transportation Leaders Against Human Trafficking Initiative. The purpose is to support the development of innovative products and services to prevent human trafficking and reduce crime on public transit vehicles and in facilities. The goals of the projects are to: 1) develop innovative projects to assist transit agencies with identifying and adopting specific measures to address public safety in transit systems, including crime prevention, human trafficking, and operator assault; and 2) maximize the transit industry’s collective impact to address human trafficking and other public safety concerns.

Results:

On January 28, 2020, Transportation Secretary Elaine L. Chao announced \$5.4 million in grant selections as part of FTA’s Human Trafficking Awareness and Public Safety Initiative at an event held at DOT’s headquarters. Of the \$5.4 million, \$3.4 million will fund 21 organizations for demonstrations and deployment projects to help prevent human trafficking and other crimes on public transportation and \$2 million will be used for technical assistance projects. All projects will be active in FY 2021.

Project/Program Evaluation:

The program will have an independent evaluation for each selected project, as statutorily required.

FTA Funding: \$3,362,874

Title: *Redesign of Transit Bus Operator Compartment to Improve Safety, Operational Efficiency, and Passenger Accessibility (Bus Operator Compartment) Program*

Recipients: Transit authorities, local governments, non-profit organizations, and state DOTs (see Table 3)

Program Description:

The purpose of this program is to develop new transit bus operator compartment designs in partnership with bus manufacturers, technology vendors, vehicle engineering and design firms, and transit agencies. The goals are to: 1) redesign bus operator compartments to improve bus operator and public safety, and 2) improve bus operator access to vehicle instruments and controls without hindering the accessibility of passengers. This program will research and develop new transit bus operator compartment designs to better protect operators from assault and improve their view of the road, while still allowing them to interact with passengers, including people with disabilities and those in need of special assistance.

Results:

On February 11, 2020, FTA announced a \$2 million Notice of Funding Opportunity (NOFO) and held a public webinar on March 4, 2020, with 82 attendees to provide guidance on the application and award process. Project selections were announced on October 8, 2020, and the selected projects will be active in FY 2021.

Project/Program Evaluation:

The program will have an independent evaluation for each selected project, as statutorily required, once the projects are active.

FTA Funding: \$1,600,000

Table 3 *Redesign of Transit Bus Operator Compartment to Improve Safety, Operational Efficiency, and Passenger Accessibility (Bus Operator Compartment) Selected Projects*

Project Title	Project Recipient	City and State	FTA Award
Implementation of Adding Shields and Barriers on Bus Fleet to Protect Bus operators.	New Orleans Regional Transit Authority (NORTA)	New Orleans, LA	\$600,000
Redesign of Transit Bus Operator Compartment to Improve Operator and Passenger Safety Project	International Transportation Learning Center	Silver Spring, MD	\$1,000,000
Total			\$1,600,000

Title: *FY 2020 Safety Research and Demonstration (SRD) Program*

Recipients: Transit authorities partnering with local governments, educational institutions, and private entities (see Table 4)

Program Description:

The FY 2020 SRD Program pursues cutting-edge technologies and innovative approaches to safety, focusing on the demonstration of technologies, safer designs, and innovative approaches to eliminate or mitigate safety hazards. Its goals are to: 1) explore advanced technologies, designs and/or practices to mitigate and prevent safety hazards on rail transit systems; and 2) evaluate the cost-effectiveness and practicability of potential solutions.

Results:

On February 13, 2020, FTA announced a \$7.3 million NOFO. FTA held a public webinar on March 4, 2020, with more than 70 attendees. Project selections were announced on October 8, 2020 for the approximate amount of \$7.5 million. FTA plans to award eight cooperative agreements to recipients and their project teams by early 2021. Selected projects will focus on preventing and mitigating suicide and trespassing hazards on rail transit systems, and improving the operational safety of shared corridor fixed guideway systems, including highway-rail grade crossing safety.

Project/Program Evaluation:

The program will issue a FY 2020 SRD Interim Evaluation Report in FY 2023 and a final evaluation report upon completion of all projects under the FY 2020 SRD Program.

FTA Funding: \$7,513,656

Table 4 FY 2020 Safety Research and Demonstration (SRD) Selected Projects

Project Title	Project Recipient	City and State	FTA Award
CTA's Third Rail Safety Enhancement Pilot Project	Chicago Transit Authority (CTA)	Chicago, IL	\$1,183,091
MDOT MTA Track Intrusion Detection and Alert System	Maryland Department of Transportation (MDOT)	Hanover, MD	\$675,000
An Artificial Intelligence-Aided System for Automated Detection of Trespassing at Grade Crossings	Rutgers, The State University of New Jersey	New Brunswick, NJ	\$357,072
Designed for Impact- Innovative Approach to Train Front-end Safety and Collision Fatality Reduction	Metropolitan Transportation Authority (MTA)	New York City, NY	\$3,450,907
Watch Out for CityLYNX! Be Streetcar Smart	City of Charlotte	Charlotte, NC	\$56,080
TriMet Risk Ranking Tool and Data Validation for Grade Crossing Safety Enhancement	Tri-County Metropolitan Transportation District of Oregon (Tri-Met)	Portland, OR	\$825,506
Transit Track Worker & First Responder Safety Protection Demonstration Project	Southeastern Pennsylvania Transportation Authority (SEPTA)	Philadelphia, PA	\$742,000
Utah Transit Authority, Suicide Prevention Research and Demonstration Project	Utah Transit Authority (UTA)	Salt Lake City, UT	\$224,000
Total			\$7,513,656

Title: *FY 2020 Safety Research and Demonstration (SRD) Program Evaluation*

Recipient: University of South Florida (USF) Center for Urban Transportation Research (CUTR)

Project Description:

This project supports FTA's FY 2020 SRD Program and meets the statutory requirement of independent research demonstration evaluation under Federal public transportation law (49 U.S.C. § 5312 (e)(4)). The goals of this project are to 1) evaluate the FY 2020 SRD projects; 2) assess the contribution of each project towards advancing FTA's SRD program goals of exploring advanced technologies, designs, or practices to mitigate and prevent safety hazards on rail transit systems and evaluating the cost-effectiveness and practicability of potential solutions; and 3) estimate the national-level impact of FY 2020 SRD projects. Each project-level evaluation has a set of performance measures established by FY 2020 SRD award recipients in coordination with the SRD evaluation team.

Results

In FY 2020, FTA and CUTR entered into a cooperative agreement and are working on setting up a data management plan template to provide to each selected recipient. The evaluation of the FY 2020 SRD Program will assess the success of the respective SRD grants and note to what extent grant recipients are meeting the goals of the program and their specific objectives.

FTA Funding: \$700,000

Title: FY 2016 Safety Research and Demonstration (SRD) Program

Recipients: Transit authorities partnering with local governments, educational institutions, and private entities (see Table 5)

Project Description:

The FY 2016 SRD Program pursues cutting-edge technologies and innovative approaches to safety, focusing on the demonstration of technologies and safer designs, and pursuing innovative approaches to eliminate or mitigate safety hazards. The program also targets collision avoidance and mitigation as well as transit worker safety protection. The program goals are to: 1) explore advanced technologies to prevent transit vehicle collisions; 2) enhance the safety of transit services by incorporating safer design elements; and 3) evaluate the cost-effectiveness and practicability of potential solutions.

Results:

In FY 2020, the FY 2016 SRD Program developed an evaluation framework that could be used as a template for other competitive research programs in the future. The program also developed a Data Collection and Management Plan template, a Project Completion Evaluation Questionnaire template, and an Evaluation Report format. FTA posted the *2016 Safety Research Demonstration (SRD) Independent Evaluation, Interim Report*, accessible at <https://rosap.ntl.bts.gov/view/dot/49551>, that provides the status of seven FY 2016 SRD projects selected to address the thematic areas of collision avoidance and mitigation and transit worker safety protections. Funding for the FY 2016 SRD Program assessed the practicality and effectiveness of potential solutions to improve safety and influence transit industry guidance and standards. The results of the program were widely applicable nationwide and will support FTA's efforts to promote safe public transportation systems.

FTA Funding: \$8,516,669

Table 5 FY 2016 SRD Projects Receiving Assistance from FTA in FY 2020

Project Title	Project Recipient	City and State	FTA Award
Pierce Transit Collision Avoidance and Mitigation Safety Demonstration	Pierce County Public Transportation Benefit Area Authority	Lakewood, WA	\$1,664,894
Transit Bus Mirror Configuration Research and Development	New York Metropolitan Transit Authority	New York City	\$880,035
CTA Operations Control Center Safety Enhancements Project	Chicago Transit Authority	Chicago, IL	\$1,078,300
Enhanced Secondary Warning System for Track Worker Protection Pilot	Sacramento Regional Transit District	Sacramento, CA	\$870,000
Fixed-Location Train Detection and Worker Warning System Demonstration	Maryland Department of Transportation	Baltimore, MD	\$688,448
Collision Avoidance and Mitigation Technologies on LA Metro Bus Pilot	Los Angeles County Metropolitan Transportation Authority	Los Angeles, CA	\$1,450,000
Track Inspector Location Awareness with Enhanced Transit Worker Protection Pilot	Washington Metropolitan Area Transit Authority	Washington, DC	\$1,884,992
Total			\$8,516,669

Title: FY 2016 Safety Research and Demonstration (SRD) Program Evaluation

Recipient: University of South Florida (USF) Center for Urban Transportation Research (CUTR)

Project Description:

This project supports FTA’s FY 2016 SRD Program and meets the statutory requirement of independent research demonstration evaluation under Federal public transportation law (49 U.S.C. § 5312 (e)(4)). The goals of this project are to: 1) evaluate the FY 2016 SRD projects; 2) assess the contribution of each project towards advancing FTA’s FY 2016 SRD Program goals of improved collision avoidance and increased worker safety; and 3) estimate the national-level impact of FY 2016 SRD projects. Each project-level evaluation has a set of performance measures established by FY 2016 SRD award recipients in coordination with the SRD evaluation team.

Results:

In May 2020, FTA published the *2016 Safety Research Demonstration (SRD) Independent Evaluation, Interim Report*, accessible at <https://rosap.ntl.bts.gov/viewdot/49551>, which summarizes each SRD project, including the performance measures established by grant recipients for the projects, and provides lessons learned to date from grant recipients.

FTA Funding: \$750,000

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

Recipients: Local governments, transit authorities, educational institutions, and private entities (see Table 6)

Project Description:

The SRER program pursues innovative approaches to eliminate or mitigate safety hazards, improve infrastructure resiliency, and improve all-hazards emergency response and recovery. SRER projects focus on reducing the risk of transit-related injuries and fatalities; identifying the most promising methods and/or technologies to deploy in public transit systems that can be hardened against natural disasters and/or catastrophic events; and improving communication with emergency responders in the event of emergencies, disruptions, and catastrophic failures. The program goals are to: 1) improve operational safety; 2) increase infrastructure or equipment resiliency; and 3) advance all-hazards emergency response and recovery methods.

Results:

In FY 2020, FTA published the following reports:

- *Smart, Shared, and Social: Enhancing All-Hazards Recovery Plans with Demand Management Technologies* (<https://rosap.ntl.bts.gov/view/dot/44116>)
- *Resilient Concrete Crosstie and Fastening System Designs for Light, Heavy and Commuter Rail Transit* (<https://rosap.ntl.bts.gov/view/dot/44121>)
- *Bus Exportable Power Supply (BEPS) System Use Strategy: Investigating the Use of Transit Buses as Emergency Generators* (<https://rosap.ntl.bts.gov/view/dot/44111>)
- *Integrated Wheel/Rail Characterization through Advanced Monitoring and Analytics, Final Report* (<https://rosap.ntl.bts.gov/view/dot/42671>).
- *Evacuation and Return: Increasing Safety and Reducing Risk* (<https://rosap.ntl.bts.gov/view/dot/42665>)
- *Driver Assist System (DAS) Technology to Support Bus-On-Shoulder (BOS) Operation* (<https://rosap.ntl.bts.gov/view/dot/42663>)
- *Connected Vehicle Infrastructure-Urban Bus Operational Safety Platform* (<https://rosap.ntl.bts.gov/view/dot/40394>)

The results of these projects, as noted in the above reports, 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.

Project/Program Evaluation:

Each project report contains its independent evaluation as an appendix.

FTA Funding: \$18,473,271

Table 6 *Innovative Safety, Resiliency, and All-Hazards Emergency Response and Recovery (SRER) Research Demonstration Projects Receiving Assistance from FTA, FY 2020*

Project Title	Project Recipient	City and State	FTA Award
Demonstration and Commercialization of LRV Bumper for Enhanced Safety in Shared Right-of-Way Street Environments	Applied Research Associates	Albuquerque, NM	\$1,323,414
Wayside Worker Protection Demonstration Project	Metropolitan Atlanta Rapid Transit Authority	Atlanta, GA	\$4,233,865
Coordinated Transit Response Planning and Operations Support Tools for Mitigating Impacts of All-Hazards Emergency Events	University of Chicago	Chicago, IL	\$2,890,600
Evacuation and Return: Increasing Safety and Reducing Risk	City of New Orleans	New Orleans, LA	\$500,329
New Jersey Transit Critical Infrastructure Storm Surge Warning System	New Jersey Transit Corporation	Newark, NJ	\$843,750
Smart, Shared, and Social: Enhancing All-Hazards Recovery Plans with Demand Management Technologies	Portland State University	Portland, OR	\$943,984
Innovative Platform Track Intrusion Detection System Technology: A Demonstration on Los Angeles Metro Rail System	Los Angeles County Metropolitan Transportation Authority	Los Angeles, CA	\$1,722,400
Resilient Concrete Crosstie and Fastening System Designs for Light Rail, Heavy Rail, and Commuter Rail Transit Infrastructure	University of Illinois	Urbana, IL	\$2,396,981
Integrated Wheel/Rail Characterization and Safety through Advanced Monitoring and Analytics	New York Metropolitan Transportation Authority	New York, NY	\$3,617,948
Total			\$18,473,271

Title: FTA Employee Safety Reporting Pilot (ESRP) Program

Recipient: The Volpe Center

Project Description:

The Public Transportation Agency Safety Plan (PTASP) regulation (49 CFR Part 673) requires applicable transit agencies to develop and implement an Employee Safety Reporting Program (ESRP). An agency’s ESRP must: 1) allow employees to report safety conditions to senior management; 2) specify protections for employees who report safety conditions to senior management; and 3) describe employee behaviors that may result in disciplinary action—and therefore would not be covered by protections. The purpose of the ESRP pilot is to assess the transit industry’s employee safety reporting processes and provide industry guidance on developing an effective ESRP.

Results:

In September 2019, the program presented on the ESRP PTASP requirements at the FTA-sponsored Joint State Safety Oversight Agency and Rail Transit Agency Workshop (attended by 282 individuals). In February 2020, FTA completed the Industry Baseline Study, Initial Impressions Interviews Briefing. The guidance document developed as a result of this research program, offers best practices

and suggested approaches, methodologies, and ideas to consider when designing and implementing an effective ESRP.

FTA Funding: \$3,000,000

Mobility Innovation

Description:

The FTA’s Mobility Innovation research program continued to strengthen the capacity of transit agencies and communities to navigate the dynamic, evolving landscape of personal mobility. FTA continued to leverage emerging and innovative technologies and facilitate public-private partnerships to allow for a user-centric approach that improves mobility options for all travelers, including travelers with disabilities, travelers from rural areas, and lower-income travelers, and for goods and services.

Objectives:

- Improve transit operations and reduce costs by leveraging public and private assets and technologies.
- Improve personal mobility by identifying and promoting seamless transportation models that engage all modes—public and private—for enhanced mobility for all travelers.

The FTA had 12 active Mobility Innovation major programs and projects in FY 2020, as shown in Table 7.

Table 7 *Mobility Innovation Programs Receiving Assistance from FTA, FY 2020*

Mobility Innovation Programs		
Type of Project	Project Title	FTA Funding
Demonstration & Deployment	Accelerating Innovative Mobility (AIM) Program	\$14,000,000
Demonstration & Deployment	Integrated Mobility Innovation (IMI) Demonstration Program	\$20,035,227
Innovation & Development	Mobility on Demand (MOD) Sandbox	\$6,773,080
Innovation & Development	Mobility on Demand (MOD) Sandbox Evaluation	\$250,000
Innovation & Development	Mobility on Demand (MOD) Metrics and Studies	\$750,000
Research	Transit Automation Analysis and Research Plan Development	\$950,000
Research	Strategic Transit Automation Research (STAR) Plan Enabling Research and Implementation	\$350,000
Research	Transit Bus Automation Strategic Partnerships	\$600,000
Research	Accessible Transportation Technologies Research Initiative (ATTRI)	\$2,500,000
Research	Mobility Payment Integration (MPI)	\$400,000
Research	Transit and Health Access Initiative	\$1,725,130
Demonstration & Deployment	Human Services Coordination Research (HSCR) Deployment Program	\$2,207,857
Total		\$50,541,294

Title: *Accelerating Innovative Mobility (AIM) Program*

Recipients: Transit authorities, state and local governments, and state DOTs in partnership with other transit providers (see Table 8)

Project Description:

The purpose of the AIM Program is to support innovation throughout the transit industry by promoting forward-thinking approaches to improve transit system design, service, and financing. The goals are to: 1) explore and validate forward-thinking approaches to improve transit system design, service, and financing; 2) provide funding to transit agencies in all types of communities—urban, suburban, rural— to identify, test, and prove new approaches, technologies and service models; 3) establish a national network of public transportation stakeholders that are incorporating innovative approaches and business models to improve mobility and that will share their project results; and 4) identify and promote the most promising and effective innovations that can be implemented more broadly through FTA’s capital programs. AIM will foster innovative transit technologies, practices, and solutions that incentivize travelers to choose public transportation, promote economic development in communities, and enhance public/private partnerships to improve personal mobility.

Results:

The FTA announced a NOFO on March 18, 2020. FTA held a public webinar on April 2, 2020, with 420 attendees to provide guidance on the application process. Project selections were announced on August 27, 2020, with 25 projects in 24 states and one territory receiving a share of the \$14 million in Federal funding. FTA will award cooperative agreements to recipients and their project teams; projects will be active in FY 2021. The AIM challenge grants will help transit agencies explore new service models that provide more efficient service. The selected projects will assist FTA’s ongoing effort to drive innovative transit technologies and practices that encourage travelers to choose public transportation, promote economic development in communities, and enhance mobility for all.

Project/Program Evaluation:

The AIM Program will have an independent evaluation for each selected project, as statutorily required once the project is active.

FTA Funding: \$14,000,000

Table 8 Accelerating Innovative Mobility (AIM) Projects Receiving Assistance from FTA, FY 2019

Project Title	Project Recipient	City and State	FTA Award
Travel Rewards Research Pilot	Los Angeles County Metropolitan Transportation Authority	Los Angeles, CA	\$700,000
Implementing App-Based, Inter-Agency Fare Purchase and Trip Planning in the Rocky Mountain West	Regional Transportation District	Denver, CO	\$687,000
Creating the World's First Integrated Mobility Solution	Delaware Transit Corporation	Dover, DE	\$317,692
Transit Integration: PSTA Direct Connect Service	Pinellas Suncoast Transit Authority	St. Petersburg, FL	\$120,000
GRTA KOKO Birds AIM for the Future Freedom of Mobility on the Patriotic Route	Guam Regional Transit Authority	Guam	\$1,950,106
RTA Regional Coordination - A Technological Solution to Coordinate Regional Transportation, Creating Efficiency in Service	Iowa Department of Transportation	Ames, IA	\$120,000
IMPACT South Cook Improving Metra, Pace and CTA Together, South Cook	Cook County Department of Transportation and Highways (CCDOTH)	Chicago, IL	\$330,000
IndyGo Mobility Concierge	Indianapolis Public Transportation Corporation	Indianapolis, IN	\$400,000
An Innovative Solution to Dynamically Manage Resource Capacity in Real-time in the Post-COVID Normal and Beyond	Transit Authority of the Lexington Fayette Urban County Government (Lextran)	Lexington, KY	\$422,625
AI Communication Platform for Revenue Expansion	Capital Area Transit System	Baton Rouge, LA	\$250,000
Installation of On-Bus Mobile Ticket Validators and Development of an Origin-Destination-Transfer (ODX) Model	Pioneer Valley Transit Authority	Springfield, MA	\$617,000
Montgomery County Mobile Ticketing Project	Montgomery County Maryland	Rockville, MD	\$468,820
IXR Mobility Multi-Mode Transit App Providing a Pathway Towards Transit Flexibility, Convenience, and Preference for the Transportation Disadvantaged	The City of Highland Park	Highland Park, IL	\$225,500
Southern Minnesota Mobility as a Service (MaaS) Platform	Minnesota Department of Transportation	St. Paul, MN	\$628,000
Cost-Effective Advanced Driver Assistance System (ADAS) to Ensure ADA-Compliant Level Boarding for Bus Rapid Transit	Kansas City Area Transportation Authority	Kansas City, MO	\$600,000
Transforming Public Transit in Wilson with Rural On-Demand Microtransit	City of Wilson	Wilson, NC	\$250,000
Beyond Verification & Validation (V&V) for CBTC/UWB Systems	Metropolitan Transit Authority (MTA)	New York City, NY	\$180,000
Enhancing Life with Automated Transportation for Everyone (ELATE)	Western Reserve Transit Authority	Youngstown, OH	\$2,331,000
Near Real-Time Large Transit Network Reporting System	Oregon Department of Transportation	Portland, OR	\$480,000
Advancing Geofencing Functionality	Rhode Island Public Transit Authority	Providence, RI	\$244,000
AI based smart dispatch for dynamic data driven Micro-Transit Service	West River Transit Authority d/b/a Prairie Hills Transit	Spearfish, SD	\$308,912

Table 8 (cont'd.) Accelerating Innovative Mobility (AIM) Projects Receiving Assistance from FTA, FY 2019

Project Title	Project Recipient	City and State	FTA Award
Memphis Integrated Mobility Framework	Memphis Area Transit Authority	Memphis, TN	\$483,000
Transits First/Last Mile Solution: the EZ Zeus, a zero-emission, Level 4, FMVSS, ADA, and Buy America-compliant Automated Shuttle Bus	Metropolitan Transit Authority of Harris County (Houston METRO)	Houston, TX	\$1,473,435
Electric Fast Foil Ferry: Re-imagining the Mosquito Fleet for Accelerating Passenger Ferry Innovation	Kitsap County Public Transportation Benefit Area	Bremerton, WA	\$372,910
Seamless Transportation Services for the Greater Morgantown Area	Monongalia Urban Mass Transit Authority dba Mountain Line Transit	Morgantown, WV	\$40,000
Total			\$14,000,000

Title: *Integrated Mobility Innovation (IMI) Demonstration Program*

Recipients: Transit authorities partnering with local governments, educational institutions, and private entities (see Table 9)

Project Description:

The IMI Program demonstrates innovative and effective practices, partnerships, and technologies to enhance public transportation effectiveness, increase efficiency, expand quality, promote safety, and improve the traveler experience. IMI helps communities make it easier for people to use transit, especially older adults and people with disabilities. The goals of the program are to: 1) explore new business approaches and emerging technology solutions that support transformational mobility services; 2) enable communities to adopt innovative mobility solutions that enhance transportation efficiency and effectiveness; and 3) facilitate the widespread deployment of proven mobility solutions that foster expanded personal mobility.

Results:

On March 16, 2020, FTA announced selections for \$20.3 million for 25 IMI projects. FTA awarded 24 projects for \$20.04 million after they were announced and worked with the recipients to finalize their statements of work. All projects will be active in FY 2021. The selected projects will advance mobility through creative partnerships and emerging technologies. Combining public and private transportation assets and strategies can greatly increase access to mobility for everyone.

Evaluation:

The IMI program will have an independent evaluation for each selected project, as statutorily required once the project is active.

FTA Funding: \$20,035,227

Table 9 *Integrated Mobility Innovation (IMI) Projects Receiving Assistance from FTA, FY 2020*

Project Title	Project Recipient	City and State	FTA Award
Centralized Mobility Management Software	Matanuska-Susitna Borough	Knik-Fairview, AK	\$231,191
Rural Multi-Modal Transit System Integrating Mobility on Demand with Payment/Ticketing	Baldwin County Commission	Bay Minette, AL	\$260,800
Developing standardized mobility payment integration and institutional capacity for rural Mobility as a Service	San Joaquin Regional Transit District	San Joaquin, CA	\$306,000
On-Demand Human Services Transportation for Older Adults, People with Disabilities, and Low-Income Individuals	City of Boulder	Boulder, CO	\$224,000
Testing and Deployment of Automated Buses on Connecticut Fastrak	Connecticut Department of Transportation	Hartford, CT	\$2,000,000
Greater Hartford Program for Innovative Mobility	Greater Hartford Transit District	Hartford, CT	\$630,000
Atlanta-Region Rider Information and Data Evaluation System (ATL RIDES)	Georgia Regional Transportation Authority for Atlanta-Region Transit Link Authority (ATL)	Atlanta, GA	\$430,400
Citylink North Mobility Payment System	Kootenai County	Coeur d'Alene, ID	\$150,000
Road to Recovery: Driving Transformational Change and Removing Barriers for the Recovery Community	Cecil County, Maryland	Elkton, MD	\$562,845
Transportation for Rural and Small Communities	Independent Transportation Network (ITN)	Portland, ME	\$1,658,025
Comprehensive Healthcare Access with Rural Transit Solutions (CHARTS)	Michigan Department of Transportation	Traverse, MI	\$276,499
Innovative Mobility Project for Arrowhead Community Transportation (IMPACT)	Arrowhead Economic Opportunity Agency	Duluth, MN	\$952,807
Northeastern Wake County Rural Microtransit Service	Wake County Human Services	Raleigh, NC	\$393,527
Tompkins Mobility-as-a-Service (MaaS) Phase I	Tompkins County	Ithaca, NY	\$820,000
Regional Cloud-Based Traffic Management Artificial Intelligence System to improve transit travel times and enhance Mobility on Demand services	Central Ohio Transit Authority	Columbus, OH	\$1,725,000
EZfare: The Gateway	Stark Area Regional Transit Authority (SARTA)	Canton, OH	\$1,997,503
Mobility on Demand	Grand Gateway Economic Development Association	Big Cabin, OK	\$1,514,479
STEPS to Mobility on Demand and Mobility Payment Integration	Tri-County Metropolitan Transportation District of Oregon	Portland, OR	\$1,812,282
Rural Integrated Mobility – Connecting paratransit and fixed-route services through modern ticketing technologies	Crawford Area Transportation Authority (CATA)	Meadville, PA	\$715,233
Expanding Rural Access to Non-Emergency Medical Transportation	Coordinated Community Transportation Systems on behalf of River Cities Public Transit	Pierre, SD	\$401,760
Boxtown/Westwood On-Demand Transit Pilot Project	Memphis Area Transit Authority	Memphis, TN	\$394,000
Arlington RAPID: Rideshare, Automation, and Payment Integration Demonstration (RAPID)	City of Arlington	Arlington, TX	\$1,698,558
Virginia Rural Microtransit Deployment Initiative	Virginia Department of Rail and Public Transportation	Wise, VA	\$160,930
Serving a Small City with Vans On Demand	Whatcom Transportation Authority (WTA)	Lynden, WA	\$719,388
Total			\$20,035,227

Title: *Mobility on Demand (MOD) Sandbox*

Recipients: Transit authorities, local governments, non-profit organizations, and private entities (see Table 10)

Project Description:

The purpose of the MOD Sandbox is to explore approaches to integrating promising new mobility concepts, technologies, and solutions to greatly enhance the personal mobility of individuals. The goals are to: 1) explore emerging technology solutions and new business approaches that have the potential to transform mobility services; 2) prepare the public transportation industry to deliver these innovative mobility solutions; and 3) enable the widespread deployment of integrated mobility solutions. The MOD Sandbox projects investigate, through real-world demonstration efforts, how new mobility solutions can be effectively integrated with existing transit systems to achieve the vision of MOD for an integrated network of safe and reliable transportation options available to all.

Results:

In FY 2020, FTA published three MOD Sandbox demonstration project reports:

- *Bay Area Rapid Transit (BART) Integrated Carpool to Transit Access Program Final Report* (<https://rosap.ntl.bts.gov/view/dot/44110>)
- *Dallas Area Rapid Transit (DART) First and Last Mile Solution* (<https://rosap.ntl.bts.gov/view/dot/49256>)
- *Fair Value Commuting, Final Report* (<https://rosap.ntl.bts.gov/view/dot/49552>)

The FTA conducted numerous webinars and stakeholder events to promote knowledge transfer and information-sharing; examples include 2020 Transportation Research Board (TRB) Annual Meeting workshops and sessions and the MOD Webinar Series (five webinars in FY 2020) through Talking Technology and Transportation (T3) webinars in collaboration with the Intelligent Transportation Systems Joint Program Office (ITS JPO). FTA hosted the MOD On-Ramp Workshop on November 21–22, 2019, in Dallas to facilitate stakeholder dialogues, promote industry preparedness for future mobility, and spotlight the Dallas Area Rapid Transit (DART) MOD Sandbox experience and lessons learned. MOD Sandbox projects play an important role in supporting the public transit industry to adopt new solutions for Mobility as a Service (MaaS), expand timely information on rides, expand services overall, and create a more traveler-centric, carefree and effective public transportation system.

FTA Funding: \$6,773,080

Table 10 *Mobility on Demand (MOD) Projects Receiving Assistance from FTA, FY 2020*

Project Title	Project Recipient	City and State	FTA Award
MOD Sandbox: Adaptive Mobility with Reliability and Efficiency	Regional Transportation Authority of Pima County	Tucson, AZ	\$669,158
MOD Sandbox: Mobility Platform	Valley Metro Rail, Inc.	Phoenix, AZ	\$1,001,000
MOD Sandbox: Bay Area Fair Value Commuting Demonstration	City of Palo Alto	Palo Alto, CA	\$1,085,000
MOD Sandbox: Los Angeles County and Puget Sound MOD Partnership	Los Angeles County Metropolitan Transportation Authority	Los Angeles, CA	\$1,350,000
MOD Sandbox: Integrated Carpool to Transit	San Francisco Bay Area Rapid Transit	San Francisco, CA	\$358,000
MOD Sandbox: Paratransit Mobility on Demand Demonstration	Pinellas Suncoast Transit Authority	St. Petersburg, FL	\$500,000
MOD Sandbox: Integrated Fare Systems – From Transit Fare to Bike Share	Chicago Transit Authority	Chicago, IL	\$400,000
MOD Sandbox: First and Last Mile Solution	Dallas Area Rapid Transit	Dallas, TX	\$1,204,000
MOD Sandbox: Limited Access Connections	Pierce County Public Transportation Benefit Area Authority	Lakewood, WA	\$205,922
Total			\$6,773,080

Title: *Mobility on Demand (MOD) Sandbox Evaluation***Recipient:** ICF International**Project Description:**

The purpose of this evaluation is to conduct a comprehensive independent evaluation of the MOD Sandbox demonstrations. The independent evaluation is required by Federal public transportation law (49 U.S.C. § 5312(e)(4)). The goals are to: 1) identify and analyze the project impacts from performance measures identified by the independent evaluator and the 11 MOD Sandbox Demonstration sites; and 2) assess the business models used, and how existing FTA policies and regulations may support or impede these new service transportation models.

Results:

The independent evaluator presented MOD Sandbox Demonstration evaluation results at the TRB Annual Meeting’s Mobility Innovation – A Vision for Our Transportation Future Workshop on January 12, 2020. In February 2020, FTA published the *Mobility on Demand (MOD) Sandbox Demonstration: BART Integrated Carpool to Transit Access Program Evaluation Report*, accessible at <https://rosap.ntl.bts.gov/view/dot/44109>. Results from the evaluation advance public transportation in the US by identifying impacts and benefits of MOD alternative transportation services. The evaluations apply lessons learned for other transportation providers interested in adopting these MOD services.

FTA Funding: \$250,000

Title: *Mobility on Demand (MOD) Metrics and Studies*

Recipient: TransitCenter, Inc.

Project Description:

The MOD Metrics and Studies project researches current and future performance measurement needs for integrated mobility environments. The goal is to develop integrated traveler- and system-centric performance strategies and supplemental performance metrics as part of FTA's MOD Program and mobility innovation initiatives.

Results:

This project examined how transit agencies can reorient their approach to meeting their objectives and goals using consistent MOD performance measures. In February 2020, FTA published *Mobility Performance Metrics (MPM) for Integrated Mobility and Beyond*, accessible at <https://rosap.ntl.bts.gov/view/dot/44117>, which presents traveler-centric mobility performance strategies and metrics and the approach for the development of those metrics.

FTA Funding: \$750,000

Title: *Transit Automation Analysis and Research Plan Development*

Recipient: The Volpe Center

Project Description:

The purpose of this effort is to implement several projects under the Strategic Transit Automation Research (STAR) Plan, which identifies specific transit bus automation research activities within a five-year horizon. Its goals are to: 1) conduct enabling research to achieve safe and effective transit automation deployments; 2) identify and resolve barriers to deployment of transit automation; 3) build awareness to socialize automation for the transit stakeholder community; 4) demonstrate market-ready technologies in real-world settings; and 5) leverage technologies from other sectors to move the transit automation industry forward. This effort assists with the acceleration of entry of manufacturers, suppliers, and transit providers into automation by building a common understanding of and resolving foundational issues such as human factors, federal policy, costs, and benefits.

Results:

In December 2019, FTA released three case studies highlighting transit automation projects conducted by Valley Metro, Pierce Transit, and the Jacksonville Transit Authority in an effort to provide knowledge transfer to

stakeholders. FTA also developed *Transit Bus Automation: State and Local Policy Scan*, published in April 2020 and accessible at <https://rosap.ntl.bts.gov/view/dot/49129>. This report documents current or anticipated non-technical challenges that State or local transit agencies may experience when implementing transit bus automation projects and provides recommendations for mitigating identified challenges and barriers. The policy scan addressed the STAR Plan goal of identifying and resolving barriers to deployment of transit automation.

FTA Funding: \$950,000

Title: *Strategic Transit Automation Research (STAR) Plan Enabling Research and Implementation*

Recipient: The Volpe Center

Project Description:

The purpose of this effort is to continue the implementation of FTA's STAR Plan, published in May 2018 and available at <https://rosap.ntl.bts.gov/view/dot/35646>. Its goals are to: 1) gain an understanding of the concerns about the viability of transit automation as an investment; 2) assess the market for automation of transit buses; 3) develop a business case for deploying automated transit buses; and 4) assist transit agencies in developing a robust, rigorous evaluation component for pilot and demonstration projects. The STAR Plan includes additional research, development, and demonstration of automation in transit bus vehicles.

Results:

In FY 2020, FTA conducted a market analysis for automated transit buses and supporting systems. The findings were documented in the *Transit Bus Automation Market Assessment*, published in October 2019 (<https://rosap.ntl.bts.gov/view/dot/42670>). FTA sponsored a webinar on November 7, 2019, to share the report results with the public that was attended by 193 persons. FTA also developed a guidance document titled *Considerations for Evaluating Automated Transit Bus Programs*, published in December 2019 (<https://rosap.ntl.bts.gov/view/dot/43600>), to assist transit agencies with planning and conducting self-evaluations. The information and results from these activities assist and encourage the transit industry in adopting automation in an informed and coordinated manner by providing an understanding of the automation market and articulating the benefits, ultimately increasing the use of automated technologies nationwide.

FTA Funding: \$350,000

Title: *Transit Bus Automation Strategic Partnerships*

Recipients: University of South Florida (USF) Center for Urban Transportation Research (CUTR)

Project Description:

The purpose of the partnerships is to supplement the work organizations are conducting on transit bus automation research and help disseminate their research findings to the broader transit community. The goals are to: 1) leverage investment by others, in both the private and public sectors; and 2) gain access to datasets and results that would otherwise be unavailable. Creating strategic partnerships with organizations conducting automated vehicle research accelerates learning about automation implementations and shares that information with the public transportation industry.

Results:

In FY 2020, FTA awarded strategic partnerships to Access Services of Los Angeles and the Port Authority of New York and New Jersey (PANYNJ). Access Services plans to demonstrate automation level 3/4 paratransit service between a light rail station and the Veterans Administration Healthcare Center in West Los Angeles. PANYNJ plans to demonstrate level 2/3 bus platooning, adaptive cruise control, and lane keeping within the contraflow exclusive bus lane between the New Jersey Turnpike and the Lincoln Tunnel. Partnering with transit agencies on their own pilots increases the opportunity for FTA to expand and accelerate learning about automation implementations and share that information with the industry. In turn, this can enhance industry knowledge regarding automation, highlight successful strategies for automation adoption, and facilitate the industry's adoption of automated technologies, which have numerous safety and economic benefits.

FTA Funding: \$600,000

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

Recipients: State DOTs, transit authorities, and non-transit providers

Project Description:

The purpose of ATTRI is to identify, coordinate, develop, and implement transformative solutions to advance accessible transportation and independent mobility. The goals are to: 1) leverage recent advances in vehicle, infrastructure, and pedestrian-based technologies; and 2) identify accessible data, mobile computing, robotics, artificial intelligence, object detection, and navigation tools to advance accessible transportation and independent mobility solutions. ATTRI is seizing on

technological advances to enable people to travel independently, regardless of their individual abilities, thus removing barriers to transportation.

Results:

In FY 2020, ATTRI completed AccessPath, a wayfinding tool for wheelchair users and people with visual disabilities, and the Smart Travel Concierge System (STCS), a suite of technologies for assessment of transportation readiness, pre-trip planning and execution, and trip virtualization activities specifically for individuals with cognitive disabilities. ATTRI also completed Safe Intersection Crossing Technology, an application developed to connect the smartphones of pedestrians with disabilities to traffic signal controllers. ATTRI conducted online forums between September 9, 2019, and October 7, 2019, and published the gathered information in the *Barriers and Solutions to Complete Trips for All, National Dialogue Report* in January 2020 (<https://ideascale.com/userimages/accounts/90/909643/BarriersandSolutionstoCompleteTripsforAllNationalOnlineDialogueSummary.pdf>). ATTRI results enable people to travel independently, regardless of their individual abilities, thus removing barriers to transportation.

FTA Funding: \$2,500,000

Title: *Mobility Payment Integration (MPI) Program*

Recipients: The Volpe Center

Project Description:

The MPI Program positions FTA to understand the advanced and evolving technologies for payment systems within the public transportation and overall mobility domains. The goals are to: 1) explore emerging and evolving solutions, and innovative operational approaches for integrated payment applications; 2) demonstrate and evaluate integrated payment solutions through investment and strategic partnerships; 3) prepare the transportation industry to utilize multimodal integrated payment applications that will enhance efficiency, improve customer convenience, and increase the effectiveness of and access to mobility services; and 4) support DOT's strategic goal of innovation by enabling the widespread deployment of multimodal integrated mobility solutions that are connected, equitable, and effective.

Results:

In FY 2020, FTA published *Mobility Payment Integration: State-of-the-Practice Scan* in October 2019, accessible at <https://rosap.ntl.bts.gov/view/dot/42672>. FTA also finalized the MPI Program Research Plan that outlines FTA's research and demonstration activities for the next five years (FY19–FY23). In addition, FTA drafted the requirements for the MPI Programmatic Area section of

the Integrated Mobility Innovation (IMI) NOFO announced in May 2019 for demonstration of payment integration solutions that are aligned with FTA objectives (<https://www.govinfo.gov/content/pkg/FR-2019-05-08/pdf/2019-09269.pdf>). The results of this program provide additional research needed to establish guidance on policy, system integration, data sharing and management, standards, and sustainable collaboration models to make informed policy and deployment decisions.

FTA Funding: \$400,000

Title: *Transit and Health Access Initiative*

Recipients: Competitively-selected Transit and Health Access demonstration recipients (see Table II)

Project Description:

The purpose of the Transit and Health Access Initiative is to test promising, replicable public transportation healthcare access solutions that support the goals of increased access to care, improved health outcomes, and reduced healthcare costs. It is associated with the Coordinated Council on Access and Mobility (CCAM), a Federal interagency council established by Executive Order 13330 in 2004. The projects leverage creative community partnerships and test systems for coordinating trips.

Results:

Four of the eight demonstration grant projects were active in FY 2020. The projects produced a number of positive results, although some projects encountered challenges when attempting to quantify outcomes, particularly individual and societal cost outcomes. Overall, program participants credited the projects with significant improvements to their health. In addition, the projects raised awareness about the connection between transportation and healthcare and opened the door for partnerships to build upon the ideas and experiences of the program.

Project/Program Evaluation:

Current active Transit and Health Access demonstration projects provide access to healthcare and other quality of life destinations to some of the most vulnerable populations—older adults, people with disabilities, and people with low incomes. These projects particularly serve populations in rural, geographically-isolated areas.

FTA Funding: \$1,725,130

Table 11 *Transit and Health Access Projects Receiving Assistance from FTA, FY 2020*

Project Title	Project Recipient	City and State	FTA Award
Blythe Wellness Express	Riverside County Transportation Commission	Riverside, CA	\$185,753
Delaware County Connections Program	Iowa Department of Transportation	Ames, IA	\$130,560
Gateway Program	Bi-State Development Agency	Saint Louis, MO	\$940,251
GO Buffalo Mom	Niagara Frontier Transportation Authority	Buffalo, NY	\$468,566
Total			\$1,725,130

Title: *Human Service Coordination Research (HSCR) Deployment Program*

Recipients: Transit authorities, local governments, non-profit organizations, and state DOTs (see Table 12)

Project Description:

The HSCR Deployment Program supports the implementation of innovative strategies to better coordinate human services transportation focused on older adults, people with disabilities, and low-income individuals. Its goals are to: 1) integrate new mobility tools such as smart phone apps and demand-responsive bus services; 2) improve multi-modal connectivity for older adults, people with disabilities and low-income individuals; 3) address accessibility issues through innovative technologies and practices; 4) improve the quality of the traveler experience and the transit product; and 5) identify new, mobility-enhancing practices and technologies. This program addresses gaps in transportation services.

Results:

On May 22, 2019, FTA announced the selection of 14 projects funded under Federal public transportation law (49 U.S.C. § 5312(b)), as shown in Table 9. FTA is working with the selected recipients to define a statement of work for each project and how they will meet the goals of HSCR. FTA expects to have the 14 projects active in FY 2021.

Project/Program Evaluation:

Under Federal public transportation law (49 U.S.C. § 5312(e)(4)), demonstration programs, including the HSCR Deployment Program, require an independent evaluation to be conducted no later than two years after the date it received assistance. The independent evaluation will be conducted by CUTR once the 14 projects are active.

FTA Funding: \$2,207,857

Table 12 Human Service Coordination Research (HSCR) Projects Receiving Assistance from FTA, FY 2020

Project	Recipient	City and State	FTA Award
Central Alabama Transportation Resource Center	United Way of Central Alabama, Inc.	Birmingham, AL	\$148,000
Bridging Medical and Healthy Food Access with Transportation in Cochise County, Arizona	Southeastern Arizona Governments Organization	Bisbee, AZ	\$235,852
Alternative Senior Transportation Service using TNCs	County of Fulton	Atlanta, GA	\$243,778
Partners for Enhanced Access to Treatment (PEAT)	Community Action Partnership of Central Illinois	Lincoln, IL	\$40,000
City of Shreveport Paratransit Passenger Portal Project	City of Shreveport	Shreveport, LA	\$54,472
Enhancing Technology Resources for Increased Mobility Options	Maryland Transit Administration	Baltimore, MD	\$240,000
Mobility Solutions for Maine: Building a Multi-Sector Network to Drive Improved Coordination and Access	Greater Portland Council of Governments	Portland, ME	\$240,000
2-1-1 NH as NH's Simplified Ride Guide	New Hampshire Department of Transportation	Concord, NH	\$17,295
NJ Transit: Transportation for Everyone Videos	NJ Transit	Newark, NJ	\$60,600
Coordinated Volunteer Transportation in Western New York State	Volunteer Transportation Center, Inc.	Watertown, NY	\$145,968
Osage Nation HSCR Project – Increasing Access to Transportation for Targeted Populations	Osage Nation	Pawhuska, OK	\$73,892
Rides Toward Work	Rhode Island Public Transit Authority	Providence, RI	\$150,000
Human Services Transportation Assistance – Bus Purchase and Operating Assistance	Southeast Tennessee Human Resource Agency	Dunlap, TN	\$388,000
Recovery Rides – Access to Substance Abuse Treatment and Employment	Vermont Agency of Transportation	Montpelier, VT	\$170,000
Total			\$2,207,857

Infrastructure

Description:

The FTA has a successful history of supporting transformative public transportation infrastructure research and demonstration projects to include those assets that are used to directly support and provide public transportation service. FTA will explore advances in technology to enhance public transportation operations across all aspects of system services—from the design of buses to effectively maintaining and managing important transit assets and ensuring state of good repair. FTA will leverage cross-modal and cross-agency relationships to identify the most promising new technologies capable of transforming public transit operations.

Objectives:

- Utilize innovative approaches to improve asset management and state of good repair.

- Promote economic growth and bus operator health and wellness through better bus designs.
- Enhance public transit operational effectiveness and efficiency through new technologies such as unmanned aerial systems, artificial intelligence, and robotics.
- Using simulation and modeling, explore new energy technologies and innovative bus designs in partnership with the U.S. Department of Energy.

The FTA had six active Infrastructure projects in FY 2020, as shown in Table 13.

Table 13 Infrastructure Programs Receiving Assistance from FTA, FY 2020

Infrastructure Programs		
Type of Project	Project Title	FTA Funding
Research	Low or No (LoNo) Emission Component Assessment Program	\$13,500,000
Innovation & Development	Low or No (LoNo) Emission Bus Testing Centers	\$2,000,000
Demonstration & Deployment	Track Asset Management Demonstration	\$4,225,000
Research	Use Cases for Unmanned Aircraft Systems (UAS) in Public Transportation Systems	\$140,000
Demonstration & Deployment	Bus Efficiency Enhancements Research and Demonstrations (BEERD) Program	\$3,000,000
Research	Bus Propulsion Evaluation and Support	\$1,400,000
Demonstration & Deployment	Low or No (LoNo) Emission Vehicle Deployment Program*	<\$65,760,844>
Total		\$24,265,000

The LoNo Program matured from a research program to a capital formula program authorized by Federal public transportation law (49 U.S.C. § 5339). The amount of \$65,760,844 is in brackets to indicate that this program separately broken out from the total of actively managed research projects.

Title: Low or No (LoNo) Emission Component Assessment Program (LoNo-CAP)

Recipients: The Ohio State University (OSU) and Auburn University (AU)

Project Description:

The purpose of LoNo-CAP is to conduct testing, evaluation, and analysis of low or no (LoNo) emission vehicle components intended for use in low or no emission vehicles, as required by Federal public transportation law (49 U.S.C. § 5312(h)). The goals of the program are to: 1) perform low or no emission component tests; 2) establish performance benchmarks for low or no emission components for vehicle manufacturers; and 3) support emerging low and no emission bus technologies and innovations. Assessing low or no emission components directly supports FTA’s statutory low and no emission transit bus capital programs by providing objective assessments of components used for low or no emission transit buses that ultimately are used in transit passenger service.

Results:

In FY 2020, FTA continued to support OSU and AU via project management and oversight teleconference calls to address project timelines, issues, or challenges and any other matters of concern such as funding eligibility requirements and intellectual property rights associated with testing. OSU and AU participated in a major industry event held by FTA in October 2019 to discuss bus maintenance and bus testing with transit agencies, transit vehicle manufacturers (TVMs), staff from DOT and FTA, Congressional staff, and industry consultants. In FY 2020, the Low or No (LoNo) Emission Bus Testing Centers were successful in terms of collaboration and awareness building that it is hoped will result in greater opportunities for the Centers in the future.

FTA Funding: \$13,500,000

Title: *Low or No (LoNo) Emission Bus Testing Centers*

Recipients: The Ohio State University (OSU) and Auburn University (AU)

Project Description:

The purpose of this effort is to establish, operate, and maintain facilities to conduct testing of new low or no (LoNo) emission bus models, as authorized by Federal public transportation law (49 U.S.C § 5312(h)). The goals of this effort are to: 1) document and support activities related to creating new testing centers; 2) conduct activities related to a facility and capability review, develop a capital project plan and a detailed budget plan; 3) develop a final report; and 4) conduct dissemination and outreach activities regarding the findings of the Centers.

Results:

The OSU and AU continue to develop their respective feasibility studies to develop LoNo Emission Bus Testing Centers. OSU performed an internal inventory of its existing testing assets in partnership with the Transportation Research Center (TRC) to determine which assets need to be upgraded, modified, and added to accommodate LoNo bus testing. AU partnered with a general engineering contracting (GEC) firm to further help develop its feasibility to study for its existing National Center for Asphalt Testing (NCAT) to accommodate LoNo bus testing. The GEC will provide an initial estimate and preliminary designs to modify the NCAT facility. FTA continues to work with both institutions providing assistance when necessary to help them achieve the prescribed milestones.

Project/Program Evaluation:

The recipients will develop a LoNo Emissions Management Plan detailing their approaches to FTA and customer communications.

FTA Funding: \$2,000,000

Title: *Track Asset Management Demonstration*

Recipients: Metropolitan Atlanta Rapid Transit Authority (MARTA)

Project Description:

The purpose of this project is to demonstrate an autonomous track inspection system (ATIS) to help FTA disseminate innovative track asset management practices to the transit industry. Its goals are to: 1) demonstrate the transferability of an ATIS system to transit; 2) demonstrate its effectiveness compared to existing transit track management practices (track inspection, data analysis, data management and maintenance); and 3) evaluate the return on investment of the system at MARTA.

Results:

The project completed a commissioning test of the Phase I ATIS system design and engineering on a work train to an industry group on November 6, 2019. On January 14, 2020, MARTA presented the status of the ATIS design, test, and data collection at the Transportation Research Board (TRB) Annual Meeting. A Phase I interim report was submitted to FTA for review on April 22, 2020. This project is the first deployment of this technology on a transit system in the US. It is assisting track workers to find track anomalies in a real-time environment.

Project/Program Evaluation:

The program is conducting an independent and continuous evaluation during the project performance period. The evaluator will include detailed information about design, issues, and resolutions in its final evaluation report.

FTA Funding: \$4,225,000

Title: *Use Cases for Unmanned Aircraft Systems (UAS) in Public Transportation Systems*

Recipient: The Volpe Center

Project Description:

The purpose of this effort is to seek application of UAS technology to public transportation systems, with a focus on two use cases permitted under current regulations—infrastructure inspection, and disaster response and recovery. The application of commercial UAS technology to public transportation operations can offer benefits in both safety and efficiency. The goals of this effort are to: 1) assist public transportation systems in determining whether to apply UAS technology to their operations; and 2) provide high-level guidance for the development of UAS programs by public transportation systems.

Results:

In FY 2020, FTA commenced the UAS study to determine the best case uses for UAS technology in the public transportation industry. The findings will be documented in a report that examines each use case from three perspectives: 1) air traffic management (ATM) for implementing UAS operations, 2) human factors considerations, and 3) cost effectiveness analysis.

FTA Funding: \$140,000

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

Recipients: Center for Transportation and the Environment (CTE) and Maryland Transit Administration (MTA) (see Table 14)

Project Description:

The purpose of the BEERD Program is to promote the development and demonstration of energy efficiency-enhancing technologies for buses used in public transportation specifically, enhanced electrification of accessories, and improvements in thermal management of bus bodies. The goals of the programs are to: 1) reduce energy use by transit buses; 2) reduce emissions, and simplify maintenance on conventional propulsion transit buses; and 3) assist the evaluation and deployment of advanced vehicle designs and technology. This program assists American transit bus manufacturers and component suppliers to achieve greater competitiveness by offering highly desirable advanced technologies for the transit industries.

Results:

In FY 2020, FTA published the following three projects reports supported by the BEERD program:

- *Reduced Engine Idle Load (REIL) System for Conventional Propulsion Diesel & CNG Buses: Development, Validation & Market Study* (<https://rosap.ntl.bts.gov/view/dot/44120>)
- *FTA Bus Efficiency Enhancements Research and Demonstration: Thermoelectric Generation Demonstration at LYNX* (<https://rosap.ntl.bts.gov/view/dot/42669>)
- *Hybrid Beltless Alternator Retrofit Program, Final Report* (<https://rosap.ntl.bts.gov/view/dot/42664>)

Results from the BEERD Program improve safety, enhance the state of good repair of transit systems, promote economic competitiveness, foster quality of life in communities, and provide environmental sustainability.

Project/Program Evaluation:

Each project selected under the BEERD Program includes a built-in, fully-funded, independent evaluation carried out by a contractor or university. Individual project evaluations will be presented to FTA in a final project report.

FTA Funding: \$3,000,000

Table 14 *Bus Efficiency Enhancements Research and Demonstrations (BEERD) Projects Receiving Assistance from FTA, FY 2020*

Project Title	Project Recipient	City and State	FTA Award
Thermoelectric Generation Demo	Center for Transportation and the Environment	Atlanta, GA	\$532,258
Reduced Engine Idle Load System	Center for Transportation and the Environment	Atlanta, GA	\$1,274,936
UTA Paratransit Accessory Electrification	Center for Transportation and the Environment	Atlanta, GA	\$697,185
Hybrid Beltless Alternator Retrofit	Maryland Transit Administration	Baltimore, MD	\$495,621
Total			\$3,000,000

Title: *Bus Propulsion Evaluation and Support*

Recipient: National Renewable Energy Laboratory (NREL), U.S. Department of Energy

Project Description:

The purpose of this project is to evaluate the performance of new bus technologies in real-world applications. The goals are to: 1) provide detailed assessments of new bus technologies in revenue service to inform decision-makers about the suitability of the technology for transit service; and 2) measure the performance of new bus technologies on regularly -scheduled bus routes over the course of at least a year. The project ensures that consistent and identical metrics and measures are applied in all technology evaluations such that all results from all evaluations can be compared across all projects over time.

Results:

In FY 2020, FTA published *Zero-Emission Bus Evaluation Results: Stark Area Regional Transit Authority Fuel Cell Electric Buses* (<https://rosap.ntl.bts.gov/view/dot/42668>). In March 2020, NREL submitted a draft report to present the results from the evaluation of 10 battery electric buses operated by Long Beach Transit (LBT) in Long Beach, CA for review. In May 2019, NREL completed an internal analysis, *Summary of NREL Evaluation Efforts for the MBTA Fuel Cell Electric Bus*. These bus technology assessments provide essential information to help transit agencies makes decisions regarding the deployment of low and no emission (LoNo) vehicles.

FTA Funding: \$1,400,000

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

Recipients: Transit authorities and project teams comprising transit agencies, systems experts, and bus manufacturers (see Table 15)

Project Description:

The FTA's LoNo program began in 2013 as a program funded under Federal public transportation law (49 U.S.C. § 5312), bridging FTA's research and capital programs. The goals of the program are to: 1) lower cost and increase availability of more energy efficient buses; 2) gain more private investment in transit bus development, and new jobs in US transit bus design and manufacturing; and 3) gain greater knowledge about strengths and weaknesses and how best to deploy the buses. The program shares the risk of early deployments of new bus technology and helps inform the industry of the capabilities and challenges of new technology.

The LoNo Program was funded for three years as a research program under Federal public transportation law (49 U.S.C. § 5312), where it gained increasing popularity and success. In FY 2016, the FAST Act authorized the LoNo Program as a capital program under Federal public transportation law (49 U.S.C. § 5339) and funding increased to \$55M annually. The program is managed by FTA's Office of Program Management and was renamed "Low-No."

Results:

In February 2020, the Center for Transportation and the Environment (CTE) submitted a draft report demonstrating how the Stark Area Regional Transit Authority (SARTA) in Canton, Ohio, used a fuel cell electric bus to train maintenance staff and as an educational outreach tool to middle school students. This project also included a study evaluating the performance of hydrogen fuel cell buses in comparison to conventional fuel technologies. In March 2020, CTE submitted a draft report detailing how it managed the extended performance testing for Alameda-Contra Costa Transit's Van Hool Fuel Cell Electric Buses (FCEBs) as they performed routine service and received regular maintenance. The impact of this program is an improved understanding of the strengths and weaknesses of electric buses and how best to deploy them. The program continues to result in improved availability of lower cost, cleaner buses and an increase in American jobs in this cutting-edge technology sector.

Project/Program Evaluation:

Through an interagency agreement with NREL, part of the U.S. Department of Energy, FTA is supporting the technology evaluations of a cross-section of LoNo project sites. NREL's evaluation measured bus technology performance on regularly-scheduled bus routes over the course of a year, with fuel economy, fuel costs, bus availability, maintenance costs, and frequency of breakdowns

addressed. Current evaluations of LoNo sites include projects in Canton, Ohio; Duluth, Minnesota; and Philadelphia, Pennsylvania. Additional technology evaluations will be performed if funding is available. For more detail about the NREL work, see the Bus Propulsion Evaluation and Support description in this report.

FTA Funding: \$65,760,844

Table 15 *Low or No (LoNo) Emission Vehicle Deployment Projects Receiving Assistance from FTA, FY 2020*

Project	Transit Agency	City and State	FTA Award
Five fuel cell electric buses	SunLine Transit Agency	Thousand Palms, CA	\$9,803,860
Five 60-ft articulated battery electric buses	Massachusetts Bay Transportation Authority	Boston, MA	\$4,139,188
5 battery electric buses	Transit Authority of River City	Louisville, KY	\$3,321,250
5 battery electric buses	San Joaquin Regional Transit District	Stockton, CA	\$4,702,011
5 battery electric buses	Duluth Transit Authority	Duluth, MN	\$6,343,890
7 battery electric buses	Dallas Area Rapid Transit Authority	Dallas, TX	\$7,637,111
5 battery electric buses	Transit Authority of Lexington Fayette Urban County	Lexington, KY	\$6,003,534
5 battery electric buses	Los Angeles County Metropolitan Transportation Authority	Los Angeles, CA	\$5,585,000
Deploy charging infrastructure for existing fleet of battery electric buses	Foothill Transit	Greater Los Angeles, CA	\$1,310,000
5 battery-electric buses	Alameda-Contra Costa Transit District Commission	Oakland, CA	\$1,551,611
Deploy 3 additional fuel cell electric buses to SARTA's fuel cell electric fleet	Stark Area Regional Transit Authority	Canton, OH	\$4,015,174
25 battery electric buses	Southeastern Pennsylvania Transportation Authority	Philadelphia, PA	\$2,585,075
5 battery electric buses	Utah Transit Authority	Salt Lake City, UT	\$5,427,100
Deploy 8 additional battery electric buses to King County's electric fleet	King County Metro	Seattle, WA	\$3,336,040
Total			\$65,760,844

Supporting Programs and Other Initiatives

Description:

The FTA has programs and projects that address cross-cutting issues associated with its three research priorities—Safety, Infrastructure, and Mobility Innovation—and to support research-to-practice implementation. In addition to those programs, FTA manages the statutorily required Transit Cooperative Research Program (TCRP) through the National Academies of Sciences, Engineering, and Medicine and the Small Business Innovation Research Program (SBIR) to support the growth of US small businesses.

Objective:

Programs under this section support FTA with dissemination, evaluation, and additional industry-driven and selected research.

Outputs:

- Develop evaluation frameworks and models to evaluate the effectiveness of research projects, priorities, and programs within a three-tiered concept.
- Support industry-driven research projects.
- Disseminate research findings.
- Ensure accessibility and Section 508 compliance of all FTA documents posted on the FTA website.

The FTA had six supporting programs and initiatives active in FY 2020, as shown in Table 16.

Table 16 *Supporting Programs and Initiatives Receiving Assistance from FTA, FY 2020*

Supporting Programs and Initiatives		
Type of Project	Project Title	FTA Funding
Research	Transit Cooperative Research Program (TCRP)	\$5,000,000
Innovative Development	Small Business Innovation (SBIR)	\$3,222,964
Evaluation & Implementation	Information Dissemination and Evaluation Program	\$1,439,692
Evaluation & Implementation	Information Dissemination and Outreach Program	\$1,100,000
Evaluation & Implementation	Research Evaluation Implementation Plan	\$480,000
Evaluation & Implementation	Transit Data Research Project Secure Data Commons System	\$100,000
Total		\$11,342,656

Title: *Transit Cooperative Research Program (TCRP)*

Recipient: National Academies of Sciences, Engineering, and Medicine (NAS)

Project Description:

The TCRP is a statutory program authorized under Federal public transportation law (49 U.S.C. § 5312(i)). Its purpose is to promote, select, and conduct research and disseminate research findings to improve the practice and performance of public transportation. Its goal is to develop near-term, practical solutions to problems facing public transportation. TCRP has an established reputation for providing useful reports and other tools to help public transportation practitioners solve problems and inform decision-makers. The TCRP Oversight and Project Selection (TOPS) Commission, consisting of senior industry leaders, represents the primary beneficiaries of TCRP research. The TOPS Commission functions as the TCRP governing board and sets research priorities. TCRP also includes FTA's strategic research goals as criteria for screening and selecting projects, helping to further extend FTA's reach.

Results:

In October 2019, the TOPS Commission selected new projects for FY 2020. Examples include the Ferry Transit Operations and Capacity Guidebook, Design Guide for Rural Deviated Fixed-Route Transit Systems, and Bus Driver Security Barrier Design—Challenges and Solutions. In addition, TCRP continued sub-programs addressing dissemination, syntheses of existing practice, legal studies, and ideas deserving exploratory analysis. TCRP supported the public transportation industry and community through conferences, webinars, and project panels, maintaining a high level of public transportation industry and stakeholder engagement. TCRP reports and studies are important resources to public transit agencies that improves operations and service.

FTA Funding: \$5,000,000

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

Recipient: The Volpe Center

Project Description:

The purpose of the SBIR Program is to help small businesses grow by funding product development research in strategic areas such as safety, operations, maintenance, and other topics important to transit. FTA is one of eight operating administrations within DOT that funds SBIR research; Federal law (15 U.S.C. § 638) mandates that each operating administration set aside a portion of its annual research budget to fund SBIR grants. FTA contributes 3.2% of its yearly research

discretionary funding to SBIR grants; FTA's FY 2020 discretionary funding amount for SBIR was \$640,000. The goals of SBIR are to: 1) stimulate technological innovation; 2) meet Federal research and development needs; 3) foster and encourage participation in innovation and entrepreneurship by women and socially or economically disadvantaged persons; and 4) increase private-sector commercialization of innovations derived from Federal research and development funding.

Results:

In January 2020, FTA and RLS & Associates developed an assessment to determine cost allocation methods that would be effective in Medicaid service delivery, focusing on cost principles and guidance to govern financial entries in any cost allocation model. SBIR research also made several improvements to a pedestrian and cyclist detection device. In January 2020, FTA and Novateur Research gathered transit driver feedback and simplified display screens by highlighting only the area of concern around the bus that is integral for passenger safety. In March 2020, Novateur continued collection of new data, re-calibrated the sensor systems of the detection device, and modified the user interface. In April 2020, FTA and Design Interactive, Inc., extended their research framework to include individuals with hearing impairments and began development of GAIT-Aids route creation with mild cognitive impairment (MCI) adaptations. They also created an augmented reality visual component, a navigational compass in 2D map layout, and intersection warnings for MCI users. Mapping capabilities are reviewed via Google Maps, and these features can be integrated with existing features and capabilities. SBIR projects drive new business development with small businesses in the US and solve pressing issues in the transportation industry.

FTA Funding: \$3,222,964

Table 17 *Small Business Innovation Research (SBIR) Projects Receiving Assistance from FTA, FY 2020*

Project Title	Project Recipient	City and State	FTA Award
Cost Allocation Technology for Non-Emergency Medical Transportation	RLS & Associates, Inc	Dayton, Ohio	\$134,328
Pedestrian and Cyclist Detection Devices for Buses	Novateur	Sterling, VA	\$749,994
Guided Augmented Independence Travel Aid (GAIT-Aid)	Design Interactive, Inc.	Orlando, FL	\$749,851
FTA Interagency Agreement with the Volpe Center for new Phase I & II projects	Volpe Center	Cambridge, MA	\$1,588,791
Total			\$3,222,964

Title: *Information Dissemination and Evaluation Program*

Recipient: University of South Florida (USF) Center for Urban Transportation Research (CUTR)

Project Description:

The purpose of this effort is to complete the evaluation of the Transit and Health Access Initiative program as required under Federal public transportation law (49 U.S.C. § 5312(e)(4)). The information dissemination component of the program was completed.

Results:

In FY 2020, CUTR conducted document reviews and a series of interviews with individual Transit and Health Access Initiative Demonstration Grants Program recipients. The documentation and interview data were analyzed to assess the projects' actual vs. expected outcomes against the overall goals of the initiative. The evaluation report, which contains an overview of the overall initiative, profiles for each of the demonstration projects including project outcomes and lessons learned and findings and recommendations, was submitted to FTA for review in June 2020. CUTR will continue to monitor the performance of each project and to conduct a comprehensive independent evaluation of the Transit and Health Access Initiative program through the duration of the project until September 30, 2020.

FTA Funding: \$1,439,692

Title: *Information Dissemination and Outreach Program*

Recipient: University of South Florida (USF) Center for Urban Transportation Research (CUTR)

Project Description:

This program assists FTA in the wide distribution of research outputs, outcomes, and impacts in a consistent and accessible way to all key stakeholders. It also assists FTA in remaining at the forefront of information accessibility by ensuring that FTA's dissemination efforts achieve the goals to: 1) edit, design, and produce consistent, accessible, high-quality research products and other supporting materials; 2) expand upon current methods of disseminating FTA research outputs, outcomes, and impacts to all key stakeholders; and 3) assist FTA with improving the management of ongoing FTA research and technology projects.

Results:

In FY 2020, FTA posted 24 final reports on its Reports and Publications page, accessible at <https://www.transit.dot.gov/research-innovation/fta-reports-and-publications> and the Repository and Open Science Access Portal (ROSA P) in the FTA collection (<https://rosap.ntl.bts.gov/cbrowse?pid=dot%3A42631&parentId=dot%3A42631>). Each report is Section 508-compliant. In addition to the posted reports, several relevant research graphics and templates were created, maintaining FTA's research brand in the transit industry. The efforts under this program provide more efficient use of resources by allowing FTA program managers and recipients to focus more on the technical content of reports rather than the report production process.

FTA Funding: \$1,100,000

Title: *Research Evaluation Implementation Plan*

Recipient: University of South Florida (USF) Center for Urban Transportation Research (CUTR)

Project Description:

The purpose is to develop an implementation plan for FTA's Nested Research Evaluation Framework, which was designed to meet the statutory requirement for the evaluation of demonstration programs. Federal public transportation law (49 U.S.C. § 5312 (e)(4)) requires FTA to conduct a comprehensive evaluation of demonstration projects not later than two years after the date on which a project receives assistance. The goal is to provide FTA program managers with a comprehensive mechanism to independently evaluate the benefits, outcomes, and return on investment of FTA-funded research programs and projects. This implementation plan provides external accountability for the use of public resources and to enable FTA to fund and prioritize research in a strategic manner.

Results:

In January 2020, FTA received a report on potential output, outcome, and impact metrics that included 23 potential performance measures for Mobility Innovation Research, 14 potential measures for Safety Research and 21 potential measures for Infrastructure Research. On February 13, 2020, FTA held a research performance measurement forum to discuss the potential measures and winnow them down to a subset of the most promising measures. In Spring 2020, FTA developed a quarterly performance scorecard for monitoring the output and outcomes of Mobility, Safety, and Innovation Research. The implementation plan will be used to meet the statutory requirement for evaluation of demonstration programs and to optimize the success of FTA's entire research program.

FTA Funding: \$480,000

Title: *Transit Data Research/Secure Data Commons System (SDC)*

Recipient: Intelligent Transportation Systems (ITS) Joint Program Office (JPO)

Project Description:

The FTA provides funding to the JPO for Phase II of Secure Data Commons (SDC), a cloud-based analytics platform that enables traffic engineers, researchers, and data scientists to access transportation-related datasets. It provides a secure platform for sharing and collaborating on research, tools, algorithms, and analysis involving sensitive datasets using commercially-available tools without needing to install tools or software locally. The SDC reduces the time from data collection to insight by allowing for real-time analysis and for project evaluators to start their analysis earlier and build on each other's work.

Results:

The FTA provided testing and input that resulted in improvements to SDC functionality, including making it easier for users to access the platform and improvements to the training materials, website, and user guide. The platform continued to add new functionality over the course of FY 2020, including enabled querying for geospatial data, an automated approach for exporting derived data, and increased data warehouse reliability. The SDC enables DOT and partners to evaluate the IMI demonstration programs and gain insights from the work FTA is sponsoring on Mobility on Demand, automated vehicles, integrated fare payment, and related topics.

FTA Funding: \$100,000

Acronyms and Abbreviations

ATTRI	Accessible Transportation Technology Research Initiative
BEERD	Bus Efficiency Enhancements Research and Demonstrations
CTE	Center for Transportation and the Environment
CUTR	Center for Urban Transportation Research at the University of South Florida
DOE	Department of Energy
DOT	Department of Transportation
FAST	Fixing America's Surface Transportation Act (Public Law 114-94)
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
FY	Fiscal Year
HST	Human Service Transportation
LoNo	Low or No Emission
MARTA	Metropolitan Atlanta Rapid Transit Authority
MOD	Mobility on Demand
NAS	National Academy of Sciences
NFCBP	National Fuel Cell Bus Program
NREL	National Renewable Energy Laboratory
SBIR	Small Business Innovation Research
SRD	Safety Research and Demonstration
SRER	Innovative Safety, Resiliency, and All-Hazards Emergency Response and Recovery Program
TCRP	Transportation Cooperative Research Program
TRB	Transportation Research Board



U.S. Department of Transportation
Federal Transit Administration

U.S. Department of Transportation
Federal Transit Administration
East Building
1200 New Jersey Avenue, SE
Washington, DC 20590

<https://www.transit.dot.gov/about/research-innovation>