

FTA Report No. 0261



# FTA Annual Report on Public Transportation Innovation Research Projects for Fiscal Year 2023

PREPARED BY  
Federal Transit Administration



U.S. Department of Transportation  
Federal Transit Administration



FEBRUARY

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## COVER PHOTO

*Courtesy of Edwin Adilson Rodriguez, Federal Transit Administration*

# **FTA Annual Report on Public Transportation Innovation Research Projects for Fiscal Year 2023**

**FEBRUARY 2024**

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PREPARED 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
ft <sup>3</sup>	cubic feet	0.028	cubic meters	m <sup>3</sup>
yd <sup>3</sup>	cubic yards	0.765	cubic meters	m <sup>3</sup>
NOTE: volumes greater than 1000 L shall be shown in m <sup>3</sup>				
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	
<p>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.</p>					
1. REPORT DATE February 2024		2. REPORT TYPE Annual		3. DATES COVERED October 1, 2022 - September 30, 2023	
4. TITLE AND SUBTITLE FTA Annual Report on Public Transportation Innovation Research Projects for FY 2023				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. 0261	
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 [ <a href="mailto:orders@ntis.gov">orders@ntis.gov</a> ]; Distribution Code TRI-30					
13. SUPPLEMENTARY NOTES [ <a href="http://www.transit.dot.gov/about/research-innovation">www.transit.dot.gov/about/research-innovation</a> ] [ <a href="https://www.transit.dot.gov/about/research-innovation">https://www.transit.dot.gov/about/research-innovation</a> ] [ <a href="https://doi.org/10.21949/1527654">https://doi.org/10.21949/1527654</a> ] Suggested citation: Federal Transit Administration. FTA Annual Report on Public Transportation Innovation Research Projects for FY 2021. Washington, D.C.: United States Department of Transportation, 2023. <a href="https://doi.org/10.21949/1527654">https://doi.org/10.21949/1527654</a>					
14. ABSTRACT This report provides information on projects funded under the Federal Transit Administration's Public Transportation Innovation Program (49 U.S.C. § 5312). FTA's over \$225 million in active research activities in FY2023 support the US Department of Transportation (DOT) strategic goals, of Safety, Equity, Transformation, Economic Strength and Global Competitiveness, Climate and Sustainability, and Organizational Excellence.					
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 57	19a. NAME OF RESPONSIBLE PERSON
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified			19b. TELEPHONE NUMBER

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U.S. Department  
of Transportation

**Federal Transit  
Administration**

Administrator

1200 New Jersey Avenue, SE  
Washington, DC 20590

Dear Colleagues:

I am pleased to provide the Federal Transit Administration (FTA) Annual Report on Public Transportation Research for Fiscal Year (FY) 2023. Issued annually by FTA, this report overviews FTA's research activities that received assistance under the Public Transportation Innovation Program (49 U.S.C § 5312) during FY 2023.

FTA led \$225 million in active projects, including funds appropriated in prior fiscal years, to support FTA's mission to improve America's communities through public transportation. These projects advanced the U.S. Department of Transportation (DOT) Strategic goals of safety, equity, economic growth and global competitiveness, transformation, and organizational excellence. They also met the strategic research goals for FTA which align with the DOT strategic goals. FTA's research goals are to facilitate equitable and accessible mobility, improve and leverage transit to reduce climate impacts, and enable a safe and secure public transit system.

FTA invested the largest amount of research funding to improve safety – \$56 million. Safety research addressed worker and rider safety, cybersecurity, and rail safety, and assessed ways to reduce trespassing and suicides. FTA continues to be an innovation investor, leveraging over \$46 million on transformative technologies such as automation, artificial intelligence, and cashless, multi-modal integrated payment. Technologies such as artificial intelligence can reduce crime and enable transit agencies to enhance their services to accommodate changing traveler destination preferences. Sensors that monitor the wear and tear of rail systems help maintain and manage critical infrastructure assets. FTA also funded \$8 million for a new equity program launched in FY 2023 to improve mobility, access, and reduce transportation insecurity for historically disadvantaged riders.

In this second year of the Bipartisan Infrastructure Law (BIL), FTA expanded advanced technology, climate, and sustainability research related to Low or No emission buses. FTA invested \$38 million of FY 2023 funds for research related to economic strength and global competitiveness for the transit vehicle manufacturer industry and transit agencies' transitioning their fleets to be carbon neutral by 2050. Additionally, FTA implemented the new provision of BIL for directed research activities at the Low or Now Component Testing Centers. The first directed research project was a study of battery thermal issues.

During this critical time in public transit, FTA strives to ensure that every dollar spent on research is solving an issue or leveraging opportunities for positive change. Thank you for your continued support of FTA's Public Transportation Innovation Program. I am proud of the results of our research investments. I hope you take a moment to review this report and learn more about our projects and programs.

Sincerely,

A handwritten signature in blue ink, reading "Nuria I. Fernandez".

Nuria I. Fernandez

## Executive Summary

The Federal Transportation Administration (FTA) Public Transportation Innovation Program (49 U.S.C. § 5312) advances innovative public transportation research by selecting, funding, and managing projects and programs of national significance that will improve public transportation. In FY 2023, FTA led a portfolio of \$225 million in active projects that support FTA's vision of a better quality of life for all built upon public transportation excellence, and FTA's mission to improve America's communities through Public Transportation.

Research activities evolve through a statutory four-phased research program lifecycle 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**



- **Foundational 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.

The strategic research goals for FTA in FY 2023 were to facilitate equitable and accessible mobility, improve and leverage transit to reduce climate impacts, and enable a safe and secure public transit system. As noted in the FTA Annual Modal Research Plan for FY 2022

(<https://www.transportation.gov/administrations/assistant-secretary-research-and-technology/federal-transit-administration-2022>), as America transitions to a post-pandemic future, research and innovation are playing an increasingly important role as public transit reinvents itself and adapts to new work and travel patterns while tackling historic inequities, reducing greenhouse gas emissions, and accelerating equitable economic growth.

FTA's innovative research activities align with the U.S. Department of Transportation (DOT) strategic goals of safety, equity, climate and sustainability, economic strength and global competitiveness, transformation, and organizational excellence. This report is organized around these goals, and each project is categorized by the primary DOT strategic goal the research is addressing. Below are descriptions of how FTA's research activities are furthering the DOT strategic goals:

- **Safety** – to research new technologies, solutions, and practices to reduce injuries and fatalities and to improve safety culture with the use of technological advancements and innovations. To operate transit systems in a safer manner through the application of advanced technologies and innovative practices that reduce transit system cybersecurity risks, threats, and vulnerabilities. Additionally, FTA’s transit automation research in automated advanced driver assistance systems and automated systems in maintenance yards is furthering safety both for transit employees and riders.
- **Equity** – to uncover the next iteration of the most promising technologies, practices, programs, and strategies to accelerate and lead public transportation transformation toward a more equitable and sustainable future.
- **Climate and Sustainability** – to harness novel renewable energy methods and advance research and innovations in climate solutions to reduce carbon footprint, tackling the climate crisis by ensuring that public transportation plays a central role in the solution.
- **Economic Strength and Global Competitiveness** – to improve the efficiency, effectiveness, and quality of FTA’s research programs through adaptation of new technologies and testing methodologies.
- **Transformation** – to advance new and emerging technologies and concepts to improve transit operations, field integrated cashless multi-modal payment systems, and provide real-time information for trip planning and ride options for travelers and understand new travel patterns and trends.
- **Organizational Excellence** – to deploy proven research solutions to improve transit service delivery. In addition, the program will continue to facilitate the implementation of research and technology development and to advance the interests of public transportation, monitor, report on, and improve outreach efforts to drive research to practice.

In FY 2023, FTA managed \$225 million in active research projects. These funds are from multiple fiscal years and included \$56 million for Safety, \$52 million for Climate and Sustainability, \$46 million for Transformation, \$38 million for Economic Strength and Global Competitiveness, \$8 million for Equity, \$4 million for Organizational Excellence, and \$23 million for the Transportation Cooperative Research Program (TCRP). TCRP receives, on average, approximately \$6 million a year, but their active portfolio, like FTA’s, goes over multiple fiscal years.

FTA also began new initiatives based on changes the Bipartisan Infrastructure Law (BIL) made to the Public Transportation Innovation Program. These initiatives included beginning to craft the Accelerating Advanced Digital Construction Management Program and collaborating with the Low or No Emissions Component Testing Centers at Ohio State and Auburn University to conduct directed technology research related to advanced vehicle technologies that provide advancements to the entire public transportation industry.

A complete list of all FTA innovative research programs and projects receiving assistance in FY 2023 is noted in Table 1. Each project is categorized by the primary DOT strategic goal the research supports. Figure 3 shows the location of FTA’s innovative research programs and projects.

**Table 1 Complete List of FY 2023 Active FTA Research Programs and Projects**

DOT Strategic Area	Project Title	FTA Funding
Safety	Advanced Driver Assistance Systems (ADAS) for Transit Buses Demonstration & Automated Transit Bus Maintenance and Yard Operations Demonstration	\$11,637,691
Safety	Public Transportation COVID-19 Research Demonstration Grant Program	\$15,780,056
Safety	Innovations in Transit Public Safety Projects	\$3,050,695
Safety	Safety Risk Management (SRM) and Analysis	\$2,000,000
Safety	Redesign of Transit Bus Operator Compartment to Improve Safety, Operational Efficiency, and Passenger Accessibility (Bus Operator Compartment) Program	\$1,600,000
Safety	FY 2020 Safety Research and Demonstration (SRD) Program	\$7,513,656
Safety	FY 2020 Safety Research and Demonstration (SRD) Program Evaluation	\$700,000
Safety	FY 2016 Safety Research and Demonstration (SRD) Program	\$5,101,740
Safety	FY 2016 Safety Research and Demonstration (SRD) Program Evaluation	\$750,000
Safety	Innovative Safety, Resiliency, and All-Hazards Emergency Response and Recovery (SRER) Program	\$1,323,414
Safety	Real-Time Transit Infrastructure and Rolling Stock Condition Assessment Demonstration Program	\$1,368,816
Safety	Track Asset Management Demonstration	\$4,225,000
Equity	Mobility, Access, and Transportation Insecurity	\$6,000,000
Equity	Human Services Coordination Research (HSCR) Deployment Program	\$1,656,094
Transformation	Enhancing Mobility Innovation (EMI) Program	\$4,050,251
Transformation	Integrated Mobility Innovation (IMI) Demonstration Program	\$19,082,420
Transformation	Mobility NeXt Research Design and Implementation	\$2,000,000
Transformation	Accelerating Innovative Mobility (AIM) Program	\$13,774,500
Transformation	Mobility Innovation Demonstration Programs Evaluation	\$3,050,000
Transformation	Innovative Technology and Mobility Solutions Project Evaluation	\$300,000
Transformation	Transit Cost and Delivery Project	\$469,565
Transformation	Energy Efficient Mobility Systems Program	\$1,000,000
Transformation	Mobility on Demand (MOD) Sandbox	\$605,922
Transformation	Mobility on Demand (MOD) Sandbox Evaluation	\$250,000
Transformation	Strategic Transit Automation Research (STAR) Plan Enabling Research and Implementation	\$350,000
Transformation	Transit Bus Automation Strategic Partnerships	\$600,000
Economic Strength and Global Competitiveness	Low or No Emission Vehicle Component Assessment (LoNo-CAP)	\$34,000,000
Economic Strength and Global Competitiveness	Small Business Innovation Research (SBIR)	\$3,781,065
Climate and Sustainability	Low or No (LoNo) Emission Vehicle Deployment Program*	\$47,969,437
Climate and Sustainability	Transit Vehicle Innovation Deployment Centers (TVIDC)	\$4,125,000
Climate and Sustainability	Transit Vehicle Exhaust Emissions Resources Project	\$199,995

DOT Strategic Area	Project Title	FTA Funding
Organizational Excellence	Information Dissemination and Outreach Program	\$1,600,000
Organizational Excellence	Research Evaluation Implementation Plan	\$480,000
Organizational Excellence	National Bus Rapid Transit Institute (NBRTI)	\$1,706,250
TCRP	Transit Cooperative Research Program (TCRP)	\$23,294,618
Total		\$225,396,185

*\*In 2016, 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)). However, the research demonstration program continued, In FY 2023 FTA is still administering and overseeing some of these projects funded under the LoNo Research Program.*

**Figure 2 Location of FTA Research Programs and Project Recipients**





## Requirements 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 must 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.
- A strategic research roadmap proposal for allocations of amounts for assistance under this section for the current and subsequent fiscal year, including anticipated work areas, proposed demonstrations, and strategic partnership opportunities.

## Program and Project Descriptions

This section of the report includes detailed descriptions of programs and projects that received assistance in FY 2023. 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 DOT strategic area in FY 2023 — Safety, Equity, Climate and Sustainability, Economic Strength and Global Competitiveness, Transformation, and Organizational Excellence — 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:

FTA's safety research program seeks to advance transit safety at all levels by leveraging innovative technologies such as artificial intelligence (AI), sensors, transit automation, and machine learning to monitor, predict and plan ways to reduce worker injuries and fatalities; advance technologies that can increase worker, rider, bicyclist, and pedestrian safety; and improve rail intersection safety. In FY 2023, the program continued to develop and manage initiatives to improve the safety of passengers, employees, emergency responders, and all others who encounter the public transportation system.

#### Objectives:

The FTA safety research program sought to:

- Support research to reduce fatalities and injuries.
- Improve safety culture with the use of technological advancements and innovations.

FTA had 12 active safety programs and projects in FY 2023, as listed in Table 2.

**Table 2** *Safety Research Programs and Projects Receiving Assistance from FTA, FY 2023*

Safety Programs	
Project Title	FTA Funding
Advanced Driver Assistance Systems (ADAS) for Transit Buses Demonstration & Automated Transit Bus Maintenance and Yard Operations Demonstration	\$11,637,691
Public Transportation COVID-19 Research Demonstration Grant Program	\$15,780,056
Innovations in Transit Public Safety Projects	\$3,050,695
Safety Risk Management (SRM) and Analysis	\$2,000,000
Redesign of Transit Bus Operator Compartment to Improve Safety, Operational Efficiency, and Passenger Accessibility (Bus Operator Compartment) Program	\$1,600,000
FY 2020 Safety Research and Demonstration (SRD) Program	\$7,513,656
FY 2020 Safety Research and Demonstration (SRD) Program Evaluation	\$700,000
FY 2016 Safety Research and Demonstration (SRD) Program	\$5,101,740
FY 2016 Safety Research and Demonstration (SRD) Program Evaluation	\$750,000
Innovative Safety, Resiliency, and All-Hazards Emergency Response and Recovery (SRER) Program	\$1,323,414

Safety Programs	
Real-Time Transit Infrastructure and Rolling Stock Condition Assessment Demonstration Program	\$1,368,816
Track Asset Management Demonstration	\$4,225,000
Total	\$55,051,068

**Title: *Advanced Driver Assistance Systems (ADAS) for Transit Buses Demonstration & Automated Transit Bus Maintenance and Yard Operations Demonstration***

**Recipients:** Transit authorities partnering with local governments, educational institutions, and private entities

**Project Description:**

ADAS aims to establish the feasibility of automated transit bus maintenance, yard operations, use cases, and improve understanding of the impacts. The goals of the demonstrations are to: 1) increase safety and efficiency; 2) create a testbed for study of technical issues, user acceptance, operational and maintenance costs, workforce training and transition, and institutional issues; and 3) spur technology development.

**Results:**

On June 8, 2023, FTA announced \$11.6 million to support six transit bus automation research projects to improve safety, efficiency, and accessibility on the road and in bus maintenance yards. Examples of projects include strategies for avoiding collisions with pedestrians, improved emergency braking, and precision movement for bus fueling, charging, and maintenance. The demonstration projects will help determine potential benefits, costs, and other impacts of transit bus automation. They will also provide transit agencies with resources, guidance, and tools to make informed deployment decisions.

**Project/Program Evaluation:**

The program will have an independent evaluation as statutorily required.

**FTA Funding:** \$11,637,691

**Table 3** *Advanced Driver Assistance Systems (ADAS) for Transit Buses Demonstration & Automated Transit Bus Maintenance and Yard Operations Demonstration Projects Receiving Assistance from FTA, FY 2023*

Project Title	Project Recipient	City and State	FTA Award
CapMetro Yard Automation Research & Deployment (YARD) Program	Capital Metropolitan Transportation Authority	Austin, TX	\$949,500
PSTA Autonomous Bus Yard Parking and Recall Demonstration	Pinellas Suncoast Transit Authority (PSTA)	St. Petersburg, FL	\$892,609
Validation and Real-World Pilot of ADAS Technologies in Large Transit Buses	University of Alabama	Tuscaloosa, AL	\$2,000,000
ADAS for Bustang Intercity and Regional Bus Transit	Colorado Department of Transportation (CDOT)	Denver, CA	\$1,253,952
CTfastrak ADAS Safety and Accessibility Deployment Project	Connecticut Department of Transportation (DTDOT)	Newington, CT	\$2,000,000
Advanced Driver Assistance Systems (ADAS) for Transit Buses Demonstration	Virginia Polytechnic Institute and State University	Blacksburg, VA	\$4,541,630
Total			\$11,637,691



## **Title: *Public Transportation COVID-19 Research Demonstration Grant Program***

**Recipients:** Transit authorities, state and local governments, and state DOTs in partnership with other transit providers (see Table 3)

### **Project Description:**

The COVID-19 Research Demonstration Grant Program develops, deploys, and demonstrates innovative solutions that improve the operational efficiency of transit agencies and enhance the mobility of transit users affected by the COVID-19 pandemic. This program is developing innovative solutions in four major areas: (1) vehicle, facility, equipment, and infrastructure cleaning and disinfection; (2) exposure mitigation measures; (3) innovative mobility such as contactless payments; and (4) actions that strengthen public confidence in taking transit trips.

### **Results:**

The active projects continued to develop, deploy, and demonstrate innovative solutions to improve the operational efficiency of transit agencies. Examples of relevant results in FY 2023 included the development of the Cybersecurity Assessment Tool for Transit (CATT), a cybersecurity assessment tool aimed to assist public transit agencies in formalizing and developing their cybersecurity program. The goal of the tool, accessible at <https://www.transit.dot.gov/research-innovation/cybersecurity-assessment-tool-transit-catt-self-assessment-package>, is to onboard public transit organizations to develop and strengthen their cybersecurity program to identify risks and prioritize activities to mitigate these risks. Another relevant example is the Virginia COVID response handbook (available at <https://drpt.virginia.gov/wp-content/uploads/2023/05/virginia-transit-crisis-response-recovery-handbook.pdf>). This project's Pandemic Response Handbook and statewide marketing campaign helped consolidate resources and produced a unified approach to pandemic response, and the recovery of ridership across the Commonwealth of Virginia.

### **Project/Program Evaluation:**

The program will have an independent evaluation as statutorily required.

**FTA Funding:** \$15,780,056

**Table 4 COVID-19 Research Demonstration Grant Projects Receiving Assistance from FTA, FY 2023**

Project Title	Project Recipient	City and State	FTA Award
COVID-19 Research Demonstration Project	Alabama Department of Transportation	Montgomery, AL	\$300,000
Rock Region METRO COVID-19 Research	Rock Region Metropolitan Transit Authority	Little Rock, AR	\$288,750
COVID-19 Research Demonstration Grant Program	City of Tucson	Tucson, AZ	\$600,000
5312 National Transit Adaptation Strategy	San Francisco Municipal Transportation Agency	San Francisco, CA	\$450,000
COVID-19 Research Demonstration - Transit Vehicle and Facility Enhancements to Mitigate COVID-19 Exposure	City of Colorado Springs	Colorado Springs, CO	\$600,000
Voice Activated Ticket Vending Machine Project	Connecticut Department of Transportation	Hartford, CT	\$450,000
COVID-19 Research and Demonstration Project	Washington Metropolitan Area Transit Authority	Washington, DC	\$600,000

Project Title	Project Recipient	City and State	FTA Award
R&D Bus Barrier- Testing and Studying of Protective Barriers	Delaware Transit Corporation	Wilmington, DE	\$450,000
Tri-Rail On-Demand Microtransit Demonstration Project	South Florida Regional Transportation Authority	Pompano Beach, FL	\$167,603
Statewide Contact-less Payment System	Georgia Department of Transportation	Atlanta, GA	\$450,000
Automatic Passenger Count (APC) Research Project	Ames Transit Agency	Ames, IA	\$450,000
COVID-19 Research Demonstration Grant - Cybersecurity Resilience Assessment Tool	Rock Island County Metropolitan Mass Transit District	Moline, IL	\$400,000
Contactless Payments with Electronic Verification	South Bend Public Transportation Corporation	South Bend, IN	\$122,638
Contactless Fare Payment System	Capital Area Transit System	Baton Rouge, LA	\$300,000
Contactless Payment System for On-Demand Rides	Montachusett Regional Transit Authority	Fitchburg, MA	\$337,500
Baltimore County Public Transportation COVID-19 Research Demonstration Discretionary	Baltimore County	Baltimore, MD	\$12,096
Ride On Crowd Sourcing System (ROCSS)	Montgomery County Maryland	Rockville, MD	\$450,000
Michigan DOT's COVID-19 Research Demonstration Application for Automated Wheelchair Securement Systems and a Smart Phone App	Michigan Department of Transportation	Lansing, MI	\$600,000
Western Minnesota Contactless Payment Project	Minnesota Department of Transportation	St. Paul, MN	\$450,000
Statewide Safe and Reliable Return-to-Work Vanpool Program	Missouri Department of Transportation	Jefferson City, MO	\$450,000
KCATA Contactless Fare Validation and Integration Project	Kansas City Area Transportation Authority	Kansas City, MO	\$450,000
Commonwealth of the Northern Mariana Islands COVID-19 Research Demonstration	Commonwealth Office of Transit Authority	Saipan, CNMI	\$300,000
Choctaw Regional Transportation and Maintenance COVID-19 Research Demonstration Project	Mississippi Band of Choctaw Indians Choctaw Transit	Choctaw, MS	\$300,000
Contactless and Cashless On-Board Fare Payment System	City of Fayetteville	Fayetteville, NC	\$355,000
Improving Safety and Security via Video Analytics in the Age of COVID-19 and Beyond	New Jersey Transit Corporation	Newark, NJ	\$600,000
5312 Public Transportation COVID-19 Demonstration - New EMV (Europay, Mastercard and Visa) Certified Electronic Validators for Contactless Payment on Fixed Route	Regional Transportation Commission of Southern Nevada	Las Vegas, NV	\$500,000
Transit's Path Forward in a Pandemic	New York Metropolitan Transportation Authority	New York, NY	\$600,000
Multimodal Planning in the COVID-19 Environment to Improve Public Confidence	Central Ohio Transit Authority	Columbus, OH	\$600,000
Healthy and Reliable Transit	City of Portland	Portland, OR	\$439,950
Mass Transit Vehicle Air Ventilation and Purification Technologies Evaluation	Southeastern Pennsylvania Transportation Authority	Philadelphia, PA	\$584,618

Project Title	Project Recipient	City and State	FTA Award
Regional Contactless Mobile Ticketing and Trip Planning App	Berkeley-Charleston-Dorchester Council of Governments	Charleston, SC	\$575,000
5312 Public Transportation COVID-19 Research Demonstration	Nashville Metropolitan Transit Authority	Nashville, TN	\$585,000
El Paso Sun Metro Innovative Payment Mobility System	City of El Paso, Mass Transit Department dba Sun Metro	El Paso, TX	\$225,000
UTA Electronic Voucher (eVoucher) Phase Two Expansion	Utah Transit Authority	Salt Lake City, UT	\$508,200
COVID-19 Transit Recovery Toolkit: Strategies Handbook and Statewide Marketing Campaign	Virginia Department of Rail and Public Transportation	Richmond, VA	\$247,500
Vermont UVC Research Grant	Vermont Agency of Transportation	Montpelier, VT	\$581,201
The Transit Validation Project	King County Metro	Seattle, WA	\$400,000
Total			\$15,780,056

### **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 (see Table 4)

#### **Project Description:**

This effort is part of FTA's Human Trafficking Awareness and Public Safety Initiative. This program supports 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:**

The active projects under this program continued to empower transit agencies and other organizations to develop local solutions to address human trafficking on public transportation. Relevant results for FY 2023 include the Regional Transportation Commission (RTC) of Southern Nevada provided funding for training of RTC's transit service contractors and provided a video, accessible at [https://www.dropbox.com/s/a9kftrlsy3v045i/TESTIMONIAL\\_MAUURICE\\_Rev2.mp4?dl=0](https://www.dropbox.com/s/a9kftrlsy3v045i/TESTIMONIAL_MAUURICE_Rev2.mp4?dl=0), that tells the story of how human trafficking training was instrumental to one bus operator who was able to save a victim. The SunLine Transit Agency, in partnership with the Coachella Valley Coalition Against Human Trafficking, implemented a Human Trafficking Awareness Campaign. The campaign informed riders and the public about the prevalence of human trafficking and how to help if someone recognizes a situation that could be an incident of human trafficking.

**FTA Funding:** \$3,050,695

**Table 5** *Innovations in Transit Public Safety Projects Receiving Assistance from FTA, FY 2023*

Project Title	Project Recipient	City and State	FTA Award
Mountain Line 5312 Transit Innovations FY 2021 - 2023	Northern Arizona Intergovernmental Public Transportation Authority	Flagstaff, AZ	\$87,612
Sun Tran Public Safety Initiative	City of Tucson	Tucson, AZ	\$221,100
Santa Clara Valley Transportation Authority (VTA) - Human Trafficking Prevention Program	Santa Clara Valley Transportation Authority	Santa Clara, CA	\$350,000
Develop and Implement a Public Service Outreach Campaign: Human Trafficking	SunLine Transit Agency	Thousand Palms, CA	\$37,320
Washington Metropolitan Area Transit Authority (WMATA) FFY 19 Section 5312 Public Safety Pilot Study	Washington Metropolitan Area Transit Authority	Washington, DC	\$176,000
Innovations in Transit Public Safety - Human Trafficking Awareness	Hillsborough Transit Authority	Tampa, FL	\$100,240
Public Safety Innovation - Live View Camera Monitoring	Gwinnett County Board of Commissioners	Lawrenceville, GA	\$352,000
Section 5312 Innovations in Transit Public Safety	Capital Area Transportation Authority	Lansing, MI	\$75,000
Train Front Line Personnel on Human Trafficking	Bi-State Development Agency	St. Louis, MO	\$187,500
Innovations in Public Safety, City of Greensboro, NC	City of Greensboro	Greensboro, NC	\$34,400
Statewide Educational and Training Program	North Carolina Department of Transportation	Raleigh, NC	\$120,000
Human Trafficking in Public Transit Awareness Campaign	Regional Transportation Commission of Southern Nevada	Las Vegas, NV	\$160,000
Crime Prevention and Public Safety Rolling Classroom for Statewide Training	Grand Gateway EDA Pelivan Transit	Big Cabin, OK	\$350,475
TriMet Operator Safety & Rider Awareness	Tri- County Metropolitan Transportation District of Oregon	Portland, OR	\$151,052
Public Safety Awareness Marketing and Public Outreach Campaign of Public Safety Officers on Transit Vehicles	Central Midlands Regional Transit Authority	Columbia, SC	\$151,776
Human Trafficking Awareness & Public Safety	South Dakota Department of Transportation	Spearfish, SD	\$60,000
Training and Awareness Campaign Against Human Trafficking	Dallas Area Rapid Transit	Dallas, TX	\$49,600
Bus Monitoring Equipment (FY 19 Innovations in Transit Public Safety)	Metropolitan Transit Authority of Harris County	Houston, TX	\$160,000
Total			\$3,050,695

**Title: *Safety Risk Management (SRM) and Analysis*****Recipients:** The Volpe Center**Program Description:**

This program supports FTA by analyzing data to assist in the identification, assessment, and prioritization of transit safety risks as well as by monitoring and

evaluating data related to mitigation strategies. Risk management is dependent on transit industry data and requires FTA to establish safety data identification and collection. The goals are to: 1) assess data needs and data quality and identify data gaps for assessing transit risks; and 2) provide recommendations for addressing data gaps and improving data quality.

**Results:**

Initial activities began in FY 2023. The Volpe Center developed a research agenda with 12 topics planned for research in the next two to three years. The Volpe Center completed research on hours of service for transit workers. The Volpe Center also analyzed and summarized responses to FTA's Special Directives on Transit Worker Assault. The Volpe Center also completed interviews with a sampling of transit agencies on the topic of customer assault prevention and began drafting a written technical report.

**FTA Funding:** \$2,000,000

**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 5)

**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 is researching and developing new transit bus operator compartment designs to enhance protection of 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:**

The innovative projects continue to explore ways to protect transit employees and passengers, as well as improve the overall safety and reliability of the service. In FY 2023, the International Transportation Learning Center (ITLC) presented a final design to FTA during interactive webinar. Currently, the ITLC team and partners are participating in information exchange meetings, webinars, and outreach events to present the operator workstation redesign and invite discussion from transit agencies, manufacturers, and other industry stakeholders. The New Orleans Regional Transit Authority completed barrier installation on 113 total buses. They were retrofitted in collaboration with New Flyer and NFI Parts and closely examined through this project. In addition, the design process influenced the configuration of 41 factory-installed barriers on new 35' and 40' New Flyer buses.

**FTA Funding:** \$1,600,000

**Table 6** *Redesign of Transit Bus Operator Compartment to Improve Safety, Operational Efficiency, and Passenger Accessibility (Bus Operator Compartment) Active Projects in FY 2023*

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 6)

#### **Program Description:**

The FY 2020 SRD Program is assessing 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 associated with 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. The program 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 practicality of potential solutions.

#### **Results:**

The eight cooperative agreements helped transit agencies across the U.S. advance new technologies to enhance safety and benefit transit riders. In FY 2023, the project lead by Rutgers made significant progress with “Artificial Intelligence Aided Light Rail Grade Crossing Violation Detection.” The research team has been able to collect five terabytes of violation video data and recorded over 100,000 violation events across 17 locations across 11 states. The project led by the Tri-County Metropolitan Transportation District of Oregon (Tri-Met) made great progress with their grade crossing risk/hazard matrix. The agency finalized a draft version of the tool and is in the process of collecting actual violation data using Artificial intelligence and video cameras to validate assumptions. TriMet is doing the validation on multiple grade-crossings and will be rotating them to different grade-crossings in the future.

**FTA Funding:** \$7,513,656

**Table 7** *FY 2020 Safety Research and Demonstration (SRD) Active Projects in FY 2023*

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	New York Metropolitan Transportation Authority	New York, NY	\$3,450,907
Watch Out for CityLYNX! Be Streetcar Smart	City of Charlotte	Charlotte, NC	\$56,080



Project Title	Project Recipient	City and State	FTA Award
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 2023, CUTR worked with FTA to review and provide comments on the six DMPs submitted by each of the project teams. CUTR also worked with FTA project managers on tracking the progress of the projects and conducted several interviews with the project managers to collect information and feedback on the progress of project implementation thus far.

**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 7)

#### **Project Description:**

The FY 2016 SRD Program funded 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 related to 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 practicality of potential solutions.

**Results:**

The FY 2023 SRD Program continued to pursue new approaches to avoid safety hazards, including exploring technologies that prevent collisions as well as those that protect transit bus operators from assault. In FY 2023, all the remaining active four projects under this program completed the research portion. Each project recipient is working to complete the rest of the deliverables for the individual projects and complete the final technical reports. All the reports are expected to be published in FY 2024.

**FTA Funding:** \$5,101,740

**Table 8** *FY 2016 SRD Projects Receiving Assistance from FTA in FY 2023*

Project Title	Project Recipient	City and State	FTA Award
CTA Operations Control Center Safety Enhancements Project	Chicago Transit Authority	Chicago, IL	\$1,078,300
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			\$5,101,740

**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:**

FTA and the independent evaluator are working with the recipients in collecting lessons learned, analysis of data generated by the projects, reviewing the final report, assisting with knowledge transfer activities, and conducting project closeout interviews, as the projects come to completion.

**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 8)

### **Project Description:**

The SRER program assesses innovative approaches to eliminate or mitigate safety hazards, improve infrastructure resiliency, and improve all-hazards emergency response and recovery. SRER projects focused on reducing the risk of transit-related injuries and fatalities and identified the most promising methods and/or technologies to deploy in public transit systems to improve resiliency. Projects demonstrated how to mitigate natural disasters and/or catastrophic events; and improve communication with emergency responders in the event of emergencies, disruptions, and major failures. The program goals were to 1) improve operational safety; 2) increase infrastructure or equipment resiliency; and 3) advance all-hazards emergency response and recovery methods.

### **Results:**

All projects under SRER are completed and the program was closed out in FY 2023. SRER published the following technical final reports:

- *LRV Bumper Safety Technology Deployment Project* (<https://rosap.ntl.bts.gov/view/dot/68381>)
- *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>)
- *Wayside Worker Protection Technology—TrackSafe Phase II Research & Demonstration* (<https://rosap.ntl.bts.gov/view/dot/56189>)
- *Platform Track Intrusion Detection System Evaluation for Los Angeles County Metropolitan Transportation Authority* (<https://rosap.ntl.bts.gov/view/dot/55686>)
- *Wayside Worker Protection Demonstration for MARTA* (<https://rosap.ntl.bts.gov/view/dot/56189>)

The results of these projects, as noted in the respective reports, enabled transit agencies to incorporate lessons learned from the demonstration projects into their own efforts to improve safety, resiliency to natural disasters, and emergency response. All the projects under the program included extensive knowledge transfer or information dissemination activities. Examples of those activities are TRB annual conferences, APTA conferences, FTA-sponsored Transit Standards Working Group, FTA Safety Office newsletters, and Transit Advisory Committee for Safety (TRACS) presentation, etc.

**Project/Program Evaluation:**

Each project report contains its independent evaluation as an appendix.

**FTA Funding:** \$1,323,414

**Table 9** *Innovative Safety, Resiliency, and All-Hazards Emergency Response and Recovery (SRER) Research Demonstration Projects Receiving Assistance from FTA, FY 2023*

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
Total			\$1,323,414

**Title:** *Real-Time Transit Infrastructure and Rolling Stock Condition Assessment Demonstration Program*

**Recipient:** Transit authorities, local governments, non-profit organizations, and state DOTs (see Table 9)

**Project Description:**

This demonstration program supports innovative approaches to eliminate or mitigate known infrastructure deficiencies in public transportation via innovative technologies and designs using state-of-the-art technologies, such as smart sensors, unmanned aerial vehicles, big data analytics and other technologies that can automatically measure, record, and report in real-time detailed information regarding the condition of the infrastructures. The goals of the program are to: 1) explore advanced cutting-edge technologies that can provide real-time condition assessment of transit capital and facilities; 2) allow a more effective way for transit agencies to assess, detect, monitor, and track deficiencies and defects related to infrastructure and rolling stock; and 3) evaluate the cost-effectiveness and the practicality of proposed state-of-the art solutions.

**Results:**

The projects under this program provided a unique opportunity for transit agencies to develop innovative technologies and designs while at the same time, furthered enhancing the safety of the transit systems. In FY 2023, Dallas Area Rapid Transit (DART) and its technology vendor, AerialOne, conducted webinar and briefed FTA leadership and staff on the progress and lessons learned of DART's Real-time Infrastructure and Asset Digital Condition Assessment Project. The Regional Transportation Commission (RTC) of Washoe County completed a working prototype of the software version showing data collection, mapping, and annotation capabilities in December 2022. This software was combined with a LiDAR (Light Detection and Ranging or Laser Imaging, Detection, and Ranging) unit installed on a passenger vehicle to demonstrate the progress of the project.

**FTA Funding:** \$1,368,816

**Table 10 Real-Time Transit Infrastructure and Rolling Stock Condition Assessment Demonstration Program Receiving Assistance from FTA in FY 2023**

Project Title	Project Recipient	City and State	FTA Award
Real Time Track and Vehicle Health Monitoring through Rail-mounted Load Quantification Smart Sensors	Board of Trustees of the University of Illinois	Champaign, IL	\$395,000
Mobile LiDAR: Modernizing Condition Assessments- An innovative approach to data acquisition	Maryland Department of Transportation	Baltimore, MD	\$150,000
The Digital Twin Paradigm for Real-Time Transit Infrastructure Maintenance	Regional Transportation Commission of Washoe County	Reno, NV	\$131,661
SEPTA Regional Rail Automated Wire Scan	Southeastern Pennsylvania Transportation Authority (SEPTA)	Philadelphia, PA	\$170,000
DART Real-time Infrastructure and Asset Digital Condition Assessment Project	Dallas Area Rapid Transit (DART)	Dallas, TX	\$184,000
Polarized Infrared and Optical Imaging System for Transit Infrastructure Condition Assessment	Utah Transit Authority (UTA)	Salt Lake City, UT	\$338,155
Total			\$1,368,816

### **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:**

In FY 2023, the Project Team (ENSCO and MARTA) demonstrated ATIS Phase 2 to transit stakeholders, including rail transit agencies and state DOTs. This live demonstration event included presentation, train ride on MARTA work train, and Question/Answer session. The team also completed retesting and commissioning activities, including hardware resolution to mitigate water intrusion, repair of inter car cable conduits, and retesting of Track Component Imaging System (TCIS) technologies, which are part of the ATIS system.

#### **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

## Equity

### Description:

FTA's equity projects and programs are designed to improve public transportation services for communities that have historically had more limited access to public transportation. The program provides for transportation activities for lower-density and lower-income portions of metropolitan areas and adjoining rural areas.

### Objective:

- To uncover the next iteration of the most promising technologies, practices, programs, and strategies to accelerate and lead public transportation transformation toward a more equitable and sustainable future.

FTA had two active Equity programs and projects in FY 2023, as shown in Table 11.

**Table 11** *Equity Programs and Projects Receiving Assistance from FTA, FY 2023*

Equity Programs	
Project Title	FTA Funding
Mobility, Access, and Transportation Insecurity	\$6,000,000
Human Services Coordination Research (HSCR) Deployment Program	\$1,656,094
Total	\$7,656,094

### **Title: *Mobility, Accessibility, and Transportation Insecurity (MATI)***

**Recipient:** University of Minnesota Center for Transportation Studies

### **Project Description:**

The purpose of MATI is to explore strategies to improve people's mobility and access to daily needs and evaluate outcomes and impacts upon individuals and communities. MATI aims to support an equitable, integrated transportation system that meets the transportation needs for low-income individuals and/or communities of need.

### **Results:**

On February 8, 2023, FTA announced the selection of the University of Minnesota Center for Transportation Studies as the program lead. The center convened the first meeting of the research committee to discuss the framework and goals of the MATI research/demonstration program. The committee consists of academicians, mobility providers, researchers, and others that are active or have a vested interest in the evolving field of transportation insecurity.

### **Project/Program Evaluation:**

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

**FTA Funding:** \$6,000,000

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

**Recipients:** Transit authorities, local governments, non-profit organizations, and state DOTs (see Table 11)

**Project Description:**

The HSCR Deployment Program supports the implementation of innovative strategies to improve human services transportation coordination for 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. Project selections were announced on May 22, 2019.

**Results:**

In FY 2023, the City of Shreveport implemented a new trip booking software and trained riders on its usage. The County of Fulton implemented an Alternative Senior Transportation Service, utilized by 80% of older users. The service made them less isolated, increased mobility to non-emergency medical appointments, and improved their health due to access to medical appointments.

**FTA Funding:** \$1,656,094

**Table 12** *Human Service Coordination Research (HSCR) Projects Receiving Assistance from FTA, FY 2023*

Project	Recipient	City and State	FTA Award
Central Alabama Transportation Research 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	\$235,352
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
Mobility Solutions for Maine: Building a Multi- Sector Network to Drive Improved Coordination and Access	Greater Portland Council of Governments	Portland, ME	\$240,000
Enhancing Technology Resources for Increased Mobility Options	Maryland Transit Administration	Baltimore, MD	\$240,000
NJ Transit: Transportation for Everyone Videos	NJ Transit	Newark, NJ	\$60,600
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
Recovery Rides – Access to Substance Abuse Treatment and Employment	Vermont Agency of Transportation	Montpelier, VT	\$170,000
<b>Total</b>			<b>\$1,656,094</b>

## Transformation

### Description:

FTA's Transformation research efforts continued to strengthen the capacity of transit agencies and communities to navigate the dynamic, evolving landscape of personal mobility. FTA leveraged emerging and transformative technologies and facilitated public-private partnerships 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.

FTA had 14 active Mobility Innovation programs and projects in FY 2023, as shown in Table 13.

**Table 13 Transformations Programs and Projects Receiving Assistance from FTA, FY 2023**

Transformation Programs and Projects	
Project Title	FTA Funding
Mobility NeXt Research Design and Implementation	\$2,000,000
Enhancing Mobility Innovation (EMI) Program	\$4,050,251
Integrated Mobility Innovation (IMI) Demonstration Program	\$19,082,420
Accelerating Innovative Mobility (AIM) Program	\$13,774,500
Mobility Innovation Demonstration Programs Evaluation	\$3,050,000
Innovative Technology and Mobility Solutions Project Evaluation	\$300,000
Transit Cost and Delivery Project	\$469,565
Energy Efficient Mobility Systems Program	\$1,000,000
Mobility on Demand (MOD) Sandbox	\$605,922
Mobility on Demand (MOD) Sandbox Evaluation	\$250,000
Strategic Transit Automation Research (STAR) Plan Enabling Research and Implementation	\$350,000
Transit Bus Automation Strategic Partnerships	\$600,000
Total	\$45,532,658

### Title: *Mobility NeXt Research Design and Implementation*

Recipients: The Volpe Center

### Project Description:

This project is developing a strategic plan for the next iteration of FTA's Mobility Innovation research for a five-year horizon. It is also conducting foundational research in mobility technologies, strategies, and tools. The focus of research is to uncover the next iteration of the most promising technologies, practices, and strategies to accelerate public transportation transformation and advance carefree mobility for all. The program will mobilize Federal and private sector

investments in mobility research to advance new models of how transportation is delivered and consumed, leveraging technologies and solutions, supporting public transportation to achieve equitable and climate smart mobility outcomes.

**Results:**

Initial research activities initiated in FY 2023, with a focus on understanding the current state of the practice, including examining existing mobility innovation deployments and scan to identify research gaps and opportunities. Work began on development of the Strategic Plan to guide Mobility NeXt implementation efforts, including development of Program goals and objectives.

**FTA Funding:** \$2,000,000

**Title: *Enhancing Mobility Innovation (EMI) Program***

**Recipient:** Transit authorities, state and local governments, and state DOTs in partnership with other transit providers (see Table 13)

**Project Description:**

The purpose of the EMI Program is to enhance mobility innovations for transit, supporting a vision for a safe, reliable, equitable and accessible mobility ecosystem for all travelers. Projects advance emerging technologies, strategies, and innovations in passenger-centric mobility in two distinct areas: concept development and/or demonstration projects that improve mobility and enhance the rider experience; and projects that support the development of software solutions to facilitate demand-response public transportation.

**Results:**

The program implements two provisions of the FY 2021 and FY 2022 Consolidated Appropriations Act (Pub. L. 116-260) that directed FTA to fund projects in these areas. In FY 2023, seven of the nine projects were awarded and launched. Project managers are meeting with the project team and conducting project kickoff meetings.

**Project/Program Evaluation:**

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

**FTA Funding:** \$4,050,251

**Table 14 *Enhancing Mobility Innovation (EMI) Projects Receiving Assistance from FTA, FY 2023***

Project Title	Project Recipient	City and State	FTA Award
San Francisco Bay Area Regional Demand Responsive Transit Brokerage Service: Software for End-to-End Demand Responsive Transit Trip Planning and Reservations	Metropolitan Transportation Commission	San Francisco, CA	\$500,000
Unify Richmond Moves: Pilot Program to Coordinate Microtransit and Paratransit Riders	City of Richmond	Richmond, CA	\$250,000
Transit App to Develop a New Digital Survey	City of Santa Monica's Big Blue Bus	Santa Monica, CA	\$330,432
Vanpool Microtransit Pilot Program	Metropolitan Washington Council of Governments	Washington, DC	\$250,000



Project Title	Project Recipient	City and State	FTA Award
Software Application for Transit Agencies to Generate Tradable Credits from Emission Reductions and Social Equity Improvements	University of Maryland-College Park	College Park, MD	\$800,000
Verifying Low-Income Fare Eligibility via Connections to other State Databases	Rochester Genesee Regional Transportation Authority	Rochester, NY	\$283,219
Software Solutions to Facilitates Integrated Demand-Response Public Transportation with Real-Time Open Data Exchange	NEOride	Wadsworth, OH	\$338,600
Pilot Program to Finetune Data by Scaling the Identification of Data Quality Issues and Sharing Improved Datasets	Mobility Data, Inc.	Portland, OR	\$798,000
Transit Data Twin and Simulator	NTT Data, Inc.	Plano, TX	\$500,000
Total			\$4,050,251

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

**Recipient:** Transit authorities partnering with local governments, educational institutions, and private entities (see Table 14)

#### **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:**

In FY 2022, the Stark Area (OH) Regional Transit Authority developed an innovative alternative payment system for mobility, business and personal applications targeted to low-income, disadvantaged, disabled, student, elderly, and other underserved populations. The Memphis Area Transit Authority started the implementation of a micro-transit on-demand project in the Boxtown/Westwood neighborhood of Memphis, a low-density, suburban neighborhood with a large elderly population and infrequent transit service. All active IMI project recipients participated in collaborative activities shared their approaches to mobility innovation, through monthly topical meetings, quarterly exchanges, and web-based informal exchanges.

#### **Evaluation:**

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

**FTA Funding:** \$19,082,420



**Table 15 Integrated Mobility Innovation (IMI) Projects Receiving Assistance from FTA, FY 2023**

Project Title	Project Recipient	City and State	FTA Award
Matanuska-Susitna Borough Centralized Mobility Management Software Project	Matanuska-Susitna Borough	Knik-Fairview, AK	\$231,191
San Joaquin Regional Transit District (RTD) FY19 Integrated Mobility Innovation (IMI)	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
Kootenai County 2019 Integrated Mobility Innovation (IMI)	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	Lansing, MI	\$276,499
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	Central Ohio Transit Authority	Columbus, OH	\$1,725,000
EZfare: The Gateway	Stark Area Regional Transit Authority (SARTA)	Canton, OH	\$1,997,503
Grand Gateway Economic Development Association - PICK 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	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
<b>Total</b>			<b>\$19,082,420</b>

## **Title: *Accelerating Innovative Mobility (AIM) Program***

**Recipient:** Transit authorities, state and local governments, and state DOTs in partnership with other transit providers (see Table 15)

### **Project Description:**

The purpose of the AIM Program is to support innovation in 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:**

AIM investments in innovation are critical for transit agencies to better meet rider expectations and adapt to changes in our transportation system. In FY 2023, AIM grant recipients continued to deploy new transportation technologies and services, including microtransit, vehicle automation, integrating ride-hailing services with transit, and contactless fare payments to benefit other public transportation providers and passengers. Examples include the Kitsap County Public Transportation Benefit Area, which made significant progress on the preliminary design to the electric fast foil ferry and launched the “Electric Fast Foil Ferry” website in April 2023 (<https://www.kitsaptransit.com/electric-fast-foil-ferry>). The North Carolina Department of Transportation and City of Wilson, NC, successfully expanded service hours and increased the number of vehicles available through RIDE, the City of Wilson’s existing public rideshare service. A final report for the “Transforming Public Transit in Wilson with Rural On-Demand Microtransit” project was completed in April 2023 (<https://www.transit.dot.gov/research-innovation/transforming-public-transit-rural-demand-microtransit-project-report-0243>). All active AIM project recipients participated in AIM Incubator and Mobility Innovation Collaborative activities to collaborate and share their approaches to mobility innovation, through monthly topical meetings, quarterly exchanges, and web-based informal exchanges.

### **Project/Program Evaluation:**

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

**FTA Funding:** \$13,774,500

**Table 16 Accelerating Innovative Mobility (AIM) Projects Receiving Assistance from FTA, FY 2023**

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	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
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	New York Metropolitan Transit Authority	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	Spearfish, SD	\$308,912
Memphis Integrated Mobility Framework	Memphis Area Transit Authority	Memphis, TN	\$483,000

Project Title	Project Recipient	City and State	FTA Award
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, 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			\$13,774,500

### **Title: *Mobility Innovation Demonstration Programs Evaluation***

**Recipient:** ICF International

#### **Project Description:**

This project supports FTA's IMI and AIM Programs and meets the statutory requirement of independent research demonstration evaluation under Federal public transportation law (49 U.S.C. § 5312 (e)(4)). The evaluation will focus on projects that seek to lead the development and deployment of innovative practices and technologies that incentivize travelers to choose public transportation, improve personal mobility, and enhance the traveler's experience. The project goals are to: 1) evaluate the IMI and AIM projects; 2) document the success and impact of individual projects and the potential impact nationally; and 3) develop a synthesis report of the IMI and AIM programs that include findings, lessons learned, and recommendations for research and policy actions.

#### **Results:**

In FY 2023, the independent evaluator developed 16 evaluation plans and submitted 14 plans to FTA for approval. The independent evaluator made 11 in-person site visits where a combination of activities such as expert interviews, focus groups, and ethnographic interviews were conducted to support the independent evaluation requirement.

**FTA Funding:** \$3,050,000

### **Title: *Innovative Technology and Mobility Solutions Project Evaluation***

**Recipient:** Michigan Department of Transportation (MDOT)

#### **Project Description:**

The project assists in the evaluation of 13 projects funded through the Michigan Mobility Challenge (MMC). The Challenge funds projects that bring together public transportation providers and technology providers to propose solutions for mobility gaps for seniors, persons with disabilities, and/or veterans within a defined geographic area in Michigan. The goals of the project are to: 1) evaluate MMC projects; 2) document the success and impact of individual projects and the potential impact nationally; and 3) develop a synthesis report of the MMC that includes findings, lessons learned, and recommendations to support future state and national innovation technology and mobility funding programs.

**Results:**

In April 2023, four interviews were conducted with internal stakeholders for overall context on the Mobility Challenge. MDOT also reviewed documents for three projects (CATA Looking Bus, New Autonomous Mobility Vision for MI, and Autonomous Wheelchair Securement) and conducted 13 interviews across those three projects.

**FTA Funding:** \$300,000

**Title: *Transit Cost and Delivery Project***

**Recipients:** Eno Center for Transportation

**Project Description:**

The purpose of this project is to analyze current and historical trends in public transit project delivery domestically and internationally to better understand the drivers behind the high transit capital project construction costs and delayed delivery timelines in the U.S. The goals are to: 1) produce a full foundational report with recommendations for federal, state, and local agencies and project sponsors; 2) develop project case studies; 3) create a database of U.S. and select international transit construction projects that lists key metrics; 4) produce a report on international decision-making processes for 10 select countries; 5) disseminate foundational report findings and execute outreach plan; and 6) plan and host a symposium on transit project delivery.

**Results:**

In FY 2023, the Eno team collected construction cost data for more than 180 domestic and international rail transit projects completed over the past 20 years. From this data, Eno's policy team collected best practices and recommendations to help professionals in the field.

**FTA Funding:** \$469,565

**Title: *Energy Efficient Mobility Systems Program***

**Recipients:** U.S. Department of Energy (DOE)

**Project Description:**

The purpose of this project is to research, develop, apply, and validate technology and/or data solutions to improve the efficiency and effectiveness of public transportation so that it better meets Americans' transportation demands. The goals are to: 1) co-fund three projects to improve energy efficiency for the delivery of public transportation services; 2) enhance the traveler experience and improve public transportation operations; and 3) promote mobility for all travelers as well as quantify the energy and mobility gains that result from using advanced technologies and service delivery strategies.

**Results:**

In FY 2023, DOE continued the with the optimization of a simulation-based artificial intelligence models to improve the charging scheduling for a fast-charging electric vehicle system. DOE also started the development of various tools to optimize the delivery and energy efficiency of public transportation service by collecting baseline data and developing and optimization of predictive artificial intelligence (AI) models across the three projects. The DOE began to establish data schema and prepare the baseline algorithms for collecting real-time origin destination data from the transit service to

enable full integration of transit and energy simulation and show how it can be used to study and understand the impact of electric vehicle fleet integration and to collect performance data for the demonstration and training of the AI models.

**FTA Funding:** \$1,000,000

### **Title: *Mobility on Demand (MOD) Sandbox***

**Recipients:** Transit authorities, local governments, non-profit organizations, and private entities (see Table 16)

#### **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:**

The MOD Sandbox demonstration project concluded in FY 2023. FTA funded 11 projects, publishing nine project final reports, 11 evaluation plans, and 11 independent evaluation reports. All reports are available at <https://www.transit.dot.gov/research-innovation/mobility-demand-mod-sandbox-program>. MOD improved transportation efficiency by promoting agile, responsive, accessible, and seamless multimodal service inclusive of transit through enabling technologies and innovative partnerships. MOD increased transportation effectiveness by ensuring that transit is fully integrated and a vital element of a regional transport network that provides consistent, reliable, and accessible service to every traveler, and MOD enhanced the customer experience by providing everyone with equitable, accessible, traveler-centric service.

**FTA Funding:** \$605,922

**Table 17** *Mobility on Demand (MOD) Project Receiving Assistance from FTA, FY 2023*

Project Title	Project Recipient	City and State	FTA Award
MOD Sandbox: Integrated Fare Systems – From Transit Fare to Bike Share	Chicago Transit Authority	Chicago, IL	\$400,000
MOD Sandbox: Limited Access Connections	Pierce County Public Transportation Benefit Area Authority	Lakewood, WA	\$205,922
Total			\$605,922

### **Title: *Mobility on Demand (MOD) Sandbox Evaluation***

**Recipients:** 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 MOD Sandbox evaluation concluded in FY 2023. ICF International completed 11 evaluation reports. Results from the evaluation advanced public transportation in the U.S. 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: *Strategic Transit Automation Research (STAR) Plan  
Enabling Research and Implementation***

**Recipients:** 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 2023, the following three research projects were funded under this project:

- Transit Bus Automation Market Assessment: an assessment of prototype and commercially available transit bus automation technologies and systems was conducted to inform FTA and the transit community of the development status and availability of automated transit buses (<https://www.transit.dot.gov/research-innovation/transit-bus-automation-market-assessment-report-0255>)
- Considerations for Evaluating Automated Transit Bus Programs: a guidance document was produced to assist transit agencies with planning and conducting self-evaluations (<https://www.transit.dot.gov/research-innovation/considerations-evaluating-automated-transit-bus-programs-report-0149>).
- Assessing Transit Providers' Internal Business Case for Transit Bus Automation: an analysis was conducted on the business case for implementing automated transit buses to help transit agencies and other transit industry stakeholders understand how agencies are approaching automation decisions (<https://www.transit.dot.gov/research-innovation/assessing-transit-providers-internal-business-case-transit-bus-automation>).

**FTA Funding:** \$350,000

**Title: *Transit Bus Automation Strategic Partnerships***

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

**Project Description:**

The purpose of the partnership 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 2023, FTA published the *Lincoln Tunnel Exclusive Bus Lane Connected Automated Bus Proof-of-Concept Demonstration Project* Final Report, accessible at <https://www.transit.dot.gov/research-innovation/lincoln-tunnel-exclusive-bus-lane-connected-automated-bus-proof-concept>. This report presents the results of the Society of Automotive Engineers' designated Level 3 connected automated bus proof of concept demonstration project to improve the operation of the contraflow Lincoln Tunnel exclusive bus lane along NJ Route 495. This route connects the New Jersey Turnpike and NJ Route 3 to the Lincoln Tunnel and the Port Authority Midtown Bus Terminal in New York City.

**FTA Funding:** \$600,000



## Economic Strength and Global Competitiveness

### Description:

FTA has a successful history supporting transformative public transportation research and demonstration projects to improve the state of good repair and modernize bus and rail fleets. FTA is exploring 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.

### Objectives:

- Utilize innovative approaches to improve real-time asset management and state of good repair.
- Enhance public transit operational effectiveness and efficiency through new technologies such as unmanned aerial systems, artificial intelligence, and robotics.

FTA had two active Economic Strength programs in FY 2023, as shown in Table 18.

**Table 18** *Economic Strength and Global Competitiveness Programs Receiving Assistance from FTA, FY 2023*

Economic Strength and Global Competitiveness Programs	
Project Title	FTA Funding
Low or No (LoNo) Emission Vehicle Component Assessment (LoNo-CAP)	\$34,000,000
Small Business Innovation Research (SBIR)	\$3,781,065
Total	\$37,781,065

### **Title: *Low or No (LoNo) Emission Vehicle Component Assessment (LoNo CAP)***

**Recipients:** The Ohio State University and Auburn University

### **Project Description:**

The purpose of the two LoNo CAP Centers, managed by The Ohio State University and Auburn University, 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 compartments for vehicle manufacturers; and 3) support emerging low and no emission bus technologies and innovations. These two centers support FTA's statutory low and no emission transit bus capital programs and economic strength and modernization goals by providing a voluntary mechanism for manufacturers to test innovations in low or no emissions components. The passage of the Bipartisan Infrastructure Law (BIL) expanded the roles of both institutions to permit directed research for LoNo components and capital expenditures which aided both research and testing efforts.

### **Results:**

In FY 2023, FTA utilized the new LoNo CAP BIL provisions to enhance the program and maximize its effectiveness for the public transportation industry. With these new capabilities, FTA realigned the program and

established new Statements of Work (SOWs) with both centers. FTA also developed a three-step directed research decision-making process including FTA and external stakeholders to inform directed research topic decisions for LoNo CAP. The new three-step process includes utilizing stakeholder focus groups to generate research topics, selecting research projects with a future FTA directed research working group, and conducting and disseminating research through partnerships and demonstrations. With the new directed research provision of BIL, OSU and AU will play a vital role to support transit agencies' safe and operationally efficient transition to zero emission fleets by 2050.

**FTA Funding:** \$34,000,000

**Table 19 Low or No (LoNo) Emission Vehicle Component Assessment (LoNo-CAP) Projects Receiving Assistance from FTA, FY 2023**

Project Title	Project Recipient	City and State	FTA Award
Low or No (LoNo) Emission Component Assessment Program (LoNo-CAP) - Auburn University	Auburn University	Auburn, AL	\$7,500,000
Low or No (LoNo) Emission Component Assessment Program (LoNo-CAP) - The Ohio State University	The Ohio State University	Columbus, OH	\$7,500,000
Low or No (LoNo) Emission Bus Testing Centers - Auburn University	Auburn University	Auburn, AL	\$5,500,000
Low or No (LoNo) Emission Bus Testing Centers - The Ohio State University	The Ohio State University	Columbus, OH	\$5,500,000
FY 2021 Appropriations – Auburn University	Auburn University	Auburn, AL	\$1,500,000
FY 2021 Appropriations – The Ohio State University	The Ohio State University	Columbus, OH	\$1,500,000
FY 2022 Appropriations – Auburn University	Auburn University	Auburn, AL	\$2,500,000
FY 2022 Appropriations – The Ohio State University	The Ohio State University	Columbus, OH	\$2,500,000
<b>Total</b>			<b>\$34,000,000</b>

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

**Recipients:** The Volpe Center

#### **Project Description:**

The purpose of the SBIR program is to encourage domestic small businesses to engage in Federal Research/Research and Development (R/R&D) with the potential for commercialization. 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 contracts. FTA contributes 3.2% of its yearly research discretionary funding to SBIR contracts; FTA's FY 2022 discretionary funding amount for SBIR was \$1,192,369. FTA's participation in the program focuses on areas such as safety, operations, maintenance, and other topics important to transit. 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 FY 2023, activities under this program, SBIR awardees, developed a prototype of two interconnected digital tools to enhance the connectivity of people to fresh healthy food. The first is a Decision-Support System (DSS) for stakeholders to help decision-makers find transport deserts and invest more efficiently and effectively in transportation and food distribution programs and a mobile app for residents to enhance people's accessibility and connectivity to healthy food in rural and urban areas across the United States. RLS & Associates, Inc. completed a Coordinating Council on Access and Mobility (CCAM) Non-Emergency Medical Transportation (NEMT) Cost Allocation Model. The model allows for more transparent cost analysis and facilitates NEMT/public transit coordination.

**FTA Funding:** \$3,781,065

**Table 20 Small Business Innovation Research (SBIR) Projects Receiving Funding from FTA, FY 2023**

Project Title	Project Recipient	City and State	FTA Award
FTA Interagency Agreement with the Volpe Center for new Phase I & II projects	Volpe Center	Cambridge, MA	\$704,000
Cost Allocation Technology for Non-Emergency Medical Transportation – Phase II	RLS & Associates, Inc.	Dayton, OH	\$719,702
Virtual and Augmented Reality to Aid Transit Use by All Travelers – Phase II	Design Interactive, Inc.	Orlando, FL	\$749,852
AI for Maintenance on Buses (AIM on Bus) – Phase I	Preteckt, Inc.	Memphis, TN	\$119,619
AI Based Predictive Capabilities for Condition-based Sanitization of Public Transit Vehicles – Phase I	Interphase Materials	Pittsburgh, PA	\$148,312
Fully Autonomous Omnidirectional Adaptive Robots for the Disinfection and Decontamination of Transit Assets – Phase I	Advent Innovations, Ltd. Co.	Columbia, SC	\$147,211
FY 2022 Set Aside.	Volpe Center	Cambridge, MA	\$1,192,369
<b>Total</b>			<b>\$3,781,065</b>

## Climate and Sustainability

### Description:

The purpose of this program is to make public transportation systems more sustainable and resilient by harnessing novel renewable energy methods and advancing research and innovations in climate solutions to reduce carbon footprint. Climate change poses a significant and growing risk to the safety, reliability, and sustainability of transportation infrastructure and operations, not to mention impacts to human health and vitality. The emergence of battery electric technologies and fuel cell and electrical propulsion systems that are zero-emissions, along with innovation in alternative renewable energy sources and cleaner electrical grids, offer increased opportunities to make public transportation carbon neutral.

### Objectives:

- Foster sustainable and resilient systems for transit vehicles and infrastructure.
- Explore ways to charge and optimize charging costs and operations for large, small, and rural transit agencies.

FTA had three climate and Sustainability projects and programs in FY 2023, as shown in Table 18.

**Table 21** *Climate and Sustainability Programs and Projects Receiving Assistance from FTA, FY 2023*

Climate and Sustainability Programs and Projects	
Project Title	FTA Funding
Low or No Emission (LoNo) Vehicle Deployment Program Program*	\$47,969,437
Transit Vehicle Innovation Deployment Centers (TVIDC)	\$4,125,000
Transit Vehicle Exhaust Emissions Resources Project	\$199,995
Total	\$52,294,432

*\* In 2016, 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)). However, the research demonstration program continued, In FY 2022 FTA is still administering and overseeing some of these projects funded under the LoNo Research Program.*

### 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 19)

### Project Description:

The FTA LoNo program began in FY 2013 as a program funded under Federal public transportation law (49 U.S.C. § 5312) and is now bridging FTA's research and capital programs. The goals of the program were to: 1) lower cost and increase availability of more energy efficient buses; 2) increase private investment in transit bus development, create new jobs in U.S. transit bus manufacturing; and 3) expand knowledge regarding the strengths and weaknesses of new bus technologies, and how best to deploy these buses. The program shared the risk of early deployments of new bus technology and helped inform the industry of the capabilities and challenges of new technologies.

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 \$55 million annually. This large competitive discretionary program is managed by FTA’s Office of Program Management and was renamed “Low-No.”

**Results:**

In FY 2023, CALSTART submitted a draft study regarding hydrogen-fired fluid heating (HFFH). The technology was investigated as a solution for zero-emission based cabin heating solutions for fuel cell electric buses (FCEBs). CALSTART submitted a draft report with an overview of the “Ohio 2” fuel cell bus that was demonstrated at the Stark Area Regional Transit Authority. The draft report explores the development and demonstration of next generation Buy America compliant fuel cell buses in a large transit fleet environment.

**Project/Program Evaluation:**

Through an interagency agreement with the National Renewable Energy Laboratory (NREL), part of the U.S. Department of Energy, FTA funded the technology evaluations of all LoNo project sites. NREL’s evaluations 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.

**FTA Funding:** \$47,969,437

**Table 22 Low or No (LoNo) Emission Vehicle Deployment Projects Receiving Assistance from FTA, FY 2023**

Project	Project Recipient	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	Duluth Transit Authority	Duluth, MN	\$6,343,890
7 battery electric buses	Dallas Area Rapid Transit	Dallas, TX	\$7,637,111
5 battery electric buses	Transit Authority of Lexington Fayette Urban County Government (Lextran)	Lexington, KY	\$6,003,534
5 battery electric buses	Los Angeles County Metropolitan Transportation Authority	Los Angeles, CA	\$5,585,000
5 battery-electric buses	Alameda-Contra Costa Transit District Commission	Oakland, CA	\$1,799,564
Deploy 8 additional battery electric buses to King County’s electric fleet	King County Metro	Seattle, WA	\$3,336,040
Total			\$47,969,437

### **Title: *Transit Vehicle Innovation Deployment Centers (TVIDC)***

**Recipients:** CALSTART, Inc. and The Center for Transportation and the Environment, Inc. (CTE)

#### **Project Description:**

The purpose of this project is to research the next generation of public transit vehicle technology and facilitate an integrated, cohesive, public transportation innovation deployment network. A key goal is to convene transit agencies and U.S. transit vehicle manufacturers that research ongoing efforts to test, deploy, and commercialize low and no emissions vehicles and related components and assess ways to ensure ease of transit agencies' modernization efforts to move to zero emissions fleets. The TVIDC researches the field and coordinates and disseminates information, including tech transfer education to the public transportation industry.

#### **Results:**

In FY 2023, CTE surveyed transit agencies and vehicle manufacturers to assess key challenges, resource gaps, and other barriers to Zero Emission Buses (ZEB) technology adoption. These surveys gathered data including current and planned fleet sizes, completed transition plans and targets, existing and needed financial resources, workforce development programming, ZEB and related program staffing, data tools, current and expected challenges. CALSTART completed and released podcast episodes related to supporting transit agencies and transit vehicle manufacturers with DOTs, TVMs, and transit agencies to discuss issues related to ZEB and charging technology. Topics included developing roadmaps for zero-emissions, working to test various technologies, and ZEB deployment and challenges.

**FTA Funding:** \$4,125,000

**Table 23** *Transit Vehicle Innovation Deployment Centers (TVIDC) Projects Receiving Assistance from FTA, FY 2023*

Project	Project Recipient	City and State	FTA Award
Transit Vehicle Innovation Deployment Centers Project	CALSTART INC	Pasadena, CA	\$1,375,000
CTE Transit Vehicle Innovation Deployment Centers (TVIDC) Project	Center for Transportation and the Environment, Inc.	Atlanta, GA	\$2,750,000
Total			\$4,125,000

### **Title: *Transit Vehicle Exhaust Emissions Resources Project***

**Recipients:** West Virginia University

#### **Project Description:**

The purpose of this effort is to support the efforts of West Virginia University (WVU) to continue to update and improve the online Integrated Bus Information System (IBIS) Transit Vehicle Emissions Resources to reflect currently available fuel and propulsion technologies. IBIS provides tools that assist transit agencies evaluate the impact of available fuel and propulsion technologies including diesel, compressed and liquefied natural gas, and hybrid-electric propulsion systems on the emissions footprint of their transit fleet.

**Results:**

This project continued to update and improve the Transit Vehicle Emissions Database and the Transit Fleet Emissions Inventory Model. WVU continued collecting additional information on vehicle and infrastructure capital costs, fuel costs, operating costs, maintenance costs, vehicle reliability and availability. This will be included in the continuing development and programming of the electricity price calculations and fuel economy into the Life Cycle Cost Model before the end of Calendar Year 2023.

**FTA Funding:** \$199,995



## Organizational Excellence

### Description:

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 U.S. small businesses.

### Objective:

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

- Deploy proven research solutions to improve transit service delivery.
- Facilitate the implementation of research and technology development.
- Advance the interests of public transportation.
- Monitor, report on, and improve outreach efforts to drive research to practice.

FTA had three active Organizational Excellence programs active in FY 2023, as shown in Table 24.

**Table 24** *Supporting Programs and Initiatives Receiving Assistance from FTA, FY 2023*

Organizational Excellence Programs and Projects	
Project Title	FTA Funding
Information Dissemination and Outreach Program	\$1,600,000
Research Evaluation Implementation Plan	\$480,000
National Bus Rapid Transit Institute (NBRTI)	\$1,706,250
Total	\$3,786,250

### 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 following goals: 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:

This program ended in FY 2023. Through this program, FTA completed posted 139 reports, including 19 in FY 2023. The final reports are on the FTA Reports and Publications page, accessible at <https://www.transit.dot.gov/research->

[innovation/fta-reports-and-publications](https://rosap.ntl.bts.gov/cbrowse?pid=dot%3A42631&parentId=dot%3A42631), 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:** \$1,600,000

### **Title: *Research Evaluation Implementation Plan***

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

#### **Project Description:**

This project developed an implementation plan for FTA's Nested Research Evaluation Framework, which was designed to develop a multi-tiered structure to support a full research lifecycle evaluation – from the project level to the overall FTA statutory program level. In addition to providing more details surrounding the Level 2 demonstration program evaluation requirements, this framework also shows how data cascades upward through discrete performance measures to assess the success of FTA's research investments.

#### **Results:**

This project ended in FY 2023. CUTR contacted all the Human Service Coordination Research (HSCR) Program recipients to discuss the status of each project, including any updated milestones/timelines, data availability, collection, and reporting. CUTR created an updated spreadsheet with documentation of project extensions and the resulting revisions to project end dates; project status update, including Covid-related and other challenges; new grantee POCs; and any other changes to projects, such as changes to project's original scope, performance measures, or partners.

**FTA Funding:** \$480,000

### **Title: *National Bus Rapid Transit Institute***

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

#### **Project Description:**

The purpose of this project is to conduct continuing research and provide technical assistance to the transit industry for bus rapid transit (BRT). The goals are to: 1) conduct research in BRT Safety, Technology, and State of Good Repair; 2) develop "best practices" manuals and tools; and 3) provide clearinghouse and technical assistance/support.

#### **Results:**

In FY 2023, CUTR submitted a draft report on an Evaluation of Alternative Fuel Vehicles in BRT Service research study to survey battery-electric and other alternative fuel vehicles (AFV) employed in BRT service. This project investigated recent data on performance and operating costs of these technologies allowing

the evaluation of their advantages and limitations, including summarizing case studies and best practices in operating battery-electric and other alternative fuel vehicles or hybrids in the BRT service. CUTR also submitted a comprehensive draft report for the BRT project, which includes all research and activities throughout its project performance period. The report will be published in FY 2024.

**FTA Funding:** \$1,706,250

## Transit Cooperative Research Program (TCRP)

### Description:

The TCRP purpose and funding level is authorized in Federal public transportation law (49 U.S.C. § 5312(i)) and operated through the Transportation Research Board (TRB). This program provides applied research with near-term, practical results addressing key challenges facing the public transportation industry. TCRP supported DOT's strategic goals of Safety, Equity, Transformation, Economic Strength and Global Competitiveness, Climate and Sustainability, and Organizational Excellence.

### Objective:

Identify the highest priority transit problems in need of research and development (R&D) investigation. Provide an opportunity for transit operators, local government officials, and many other constituents – including construction organizations, financiers, real estate developers, and community representatives – to identify problems and participate in developing appropriate solutions.

### Outputs:

- Call to public transportation stakeholders and related industries for members of the public to identify challenges to be addressed.
- Production of publications.
- Continue the dissemination and share research results through events, bulletins, webinars, and email blasts.

## Title: *Transit Cooperative Research Program (TCRP)*

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

### Project Description:

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:

The Bipartisan Infrastructure Law (BIL) appropriated \$6,716,026 in FY 2023 to carry out TCRP. These appropriated funds are aggregated to active projects from previous fiscal years, totaling \$23,294,618. In FY 2023, TCRP published 18 publications, including seven research reports, nine syntheses, one legal research digest, and two web-only documents. The TOPS Commission met in June 2022 to select six new members and receive updates on TCRP projects. Project sponsors presented the results of four projects in Employee Safety Reporting Systems, Joint Development, Improving Diversity, and Inclusion, and

Transit ITS Data Management. TRB staff provided updates on Dissemination and Implementation of TCRP Research, The Transit IDEA Program, Legal Issues, and Quick Response Research.

**FTA Funding:** \$23,294,618

**Table 25** *Transit Cooperative Research Program (TCRP) Projects Receiving Assistance from FTA, FY 2023*

Project	Project Recipient	City and State	FTA Award
TCRP 29th Year - FY 2020	National Academy of Sciences	Washington, DC	\$5,000,000
TCRP 30th Year - FY 2021	National Academy of Sciences	Washington, DC	\$5,000,000
TCRP 31st Year - FY 2022	National Academy of Sciences	Washington, DC	\$6,578,592
TCRP 32nd Year - FY 2023	National Academy of Sciences	Washington, DC	\$6,716,026
Total			\$23,294,618

## Strategic Research Roadmap

Federal public transportation law (49 U.S.C. § 5312(f)(c)) requires FTA to provide a strategic research roadmap proposal for allocations of amounts for assistance under this section for the current and subsequent Fiscal Year (FY), including anticipated work areas, proposed demonstrations, and strategic partnership opportunities.

FTA's planned research allocations for FY 2023 and proposed allocations for FY 2024 are noted below, as referenced in the FY 2023 Enacted Appropriation and in the FY 2024 President's Budget:

**Table 26 Research Allocations for FY 2023 and Proposed Allocations for FY 2024 (in Millions)**

Program	FY 2023 Enacted (\$000)	FY 2024 President's Budget (\$000)
<b>PUBLIC TRANSPORTATION INNOVATION</b>		
Strategic Transit Automation Program	\$7,000	\$5,000
Transit Cybersecurity	\$2,000	
Advanced Digital Construction Management	\$3,000	\$1,500
Low No Component Testing	\$5,105	\$5,238
Small Business Innovation Research (SBIR)	\$825	\$847
Bus Testing Learning Lab	\$2,000	
Transit Cooperative Research Program (TCRP)	\$6,716	\$6,891
Safety	\$8,964	\$10,000
Technology Transfer and Performance	\$2,000	\$2,000
Mobility Innovation		\$7,116
<b>Sub-total Transit Formula Grants</b>	<b>\$37,610</b>	<b>\$38,592</b>
<b>TRANSIT INFRASTRUCTURE GRANTS</b>		
SBIR	\$224	
Research – Innovative Mobility Solutions	\$968	
Research – Innovation Accelerate Mobility Initiatives	\$968	
Research – Accelerate Adoption of Zero Emission Busses	\$4,840	
<b>Sub-total Transit Infrastructure Grants</b>	<b>\$7,000</b>	
<b>TRANSIT RESEARCH</b>		
Mobility NeXt		\$7,924
Environmental Sustainability and Resiliency		\$5,000
Transit Defined Systems		\$9,116
Transit Enhanced Living		\$7,000
SBIR		\$960
<b>Sub-total Transit Research</b>	<b>\$44,610</b>	<b>\$30,000</b>
<b>Total</b>	<b>\$44,610</b>	<b>\$68,592</b>

## **Anticipated Work Areas/Programs**

In accordance with FTA's FY 2023 Annual Modal Research Plan, FTA will allocate FY 2023 funds toward the following projects, grouped by DOT strategic goals:

### ***Safety***

Safety – to research new technologies, solutions, and practices to reduce injuries and fatalities and to improve safety culture with the use of technological advancements and innovations, working toward a future where public transportation-related serious injuries and fatalities are eliminated.

### ***Equity***

Mobility NeXt – to uncover the next iteration of the most promising technologies, practices, programs, and strategies to accelerate and lead public transportation transformation toward a more equitable and sustainable future.

### ***Climate and Sustainability***

Environmental Sustainability and Resiliency – to harness novel renewable energy methods and advance research and innovations in climate solutions to reduce carbon footprint, tackling the climate crisis by ensuring that public transportation plays a central role in the solution.

### ***Economic Strength and Global Competitiveness***

Small Business Innovation Research Program (SBIR) – a statutory program where FTA, like other DOT operating administrations, applies 3.2 percent of discretionary research funds for research in products and services needed by FTA that small businesses can develop and make commercially available.

### ***Transformation***

Strategic Transit Automation Research Program – to advance the research, development, and deployment of transit bus automation and the application of automated driving systems learnings.

Advanced Digital Construction Management Systems Program – to accelerate the adoption of advanced digital systems applied throughout the lifecycle of transportation infrastructure through the planning, design, engineering, construction, operations, and maintenance phases. To advanced digital construction management systems, practices, performance, and benefits to reduce public transportation-related disparities, adverse community impacts, and health effects.

### ***Organizational Excellence***

Technology Transfer, Performance, and Dissemination – to deploy proven research solutions to improve transit service delivery. In addition, the program will continue to facilitate the implementation of research and technology development and to advance the interests of public transportation, monitor, report on, and improve outreach efforts to drive research to practice.



## Strategic Partnerships

Collaboration is at the heart of FTA's innovative research and is done through two primary ways – partnerships with recipients of funding and partnerships with non-funded entities. FTA collaborates with internal and external partners. Internal partners are other DOT modal partners, the Joint Program Office, the Office of the Secretary, the Volpe Center, and the Bureau of Transportation Statistics. External partnerships include diverse and broad entities including nonprofit organizations, academic institutions, transportation industry associations, and private sector organizations, as well as local/state/Federal governmental entities.

FTA has long established collaborations with academic institutions, industry-leading nonprofits, and diverse Federal partners. Auburn University, The Ohio State University, and the Altoona Bus Testing Center at Penn State University lead LoNo emission component testing and bus testing. The Center for Urban Transportation Research (CUTR) at the University of South Florida, the Virginia Tech Transportation Institute, and the Texas A&M Transportation Institute provide vital expertise in safety and project evaluation. The Center for Transportation and the Environment (CTE) and CALSTART provide critical research in electrification and carbon emissions research, electrification, alternative fuel buses and carbon emission research. FTA also routinely collaborates with the U.S. Department of Energy's National Renewable Energy Laboratory (NREL) and Vehicle Technology Office.

Collaboration is a core element of FTA's over 15 years of mobility research. National associations like the American Public Transportation Association (APTA); and the Community Transportation Association of America (CTAA) and nonprofit partners like the Shared Use Mobility Center and Intelligent Transportation Systems (ITS) America as well as evaluation partners such as ICF International have helped FTA research, demonstrate, and feature mobility innovations spanning new mobility as a service models; smartphone apps; transit automation; and cashless integrated payment systems. FTA also benefits from interagency partnerships that further accessibility. The Accessible Transportation Technology Research Initiative (ATTRI) partners closely with the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR). Additionally, FTA partners with other DOT modes in mobility research including the Federal Highway Administration (FHWA), the Office of the Assistant Secretary for Research and Technology (OST-R), and the Intelligent Transportation Systems Joint Program Office (JPO). FTA is leveraging previous research in unmanned aerial systems from the Federal Aviation Administration (FAA) and the Federal Railroad Administration (FRA) to inform its work in this relatively new area for public transit agencies.

Collaboration is also a key facet of responding to the COVID-19 public health emergency, and Federal agencies such as the Environmental Protection Agency (EPA) and the Department of Homeland Security (DHS) are sharing their COVID-19 related research activities.

FTA is active with the Transportation Research Board (TRB) of the National Academy of Sciences, Engineering, and Medicine (NASEM). In addition to the Transit Cooperative Agreement Program (TCRP), FTA works closely with TRB on a number of other important activities. Yearly, FTA participates in the TRB Annual Meeting, and sometimes funds special projects with TRB. TRB hosts the Transport Research International Documentation (TRID), which contains over 1.3 million records of transportation research worldwide, combined from TRB's

Transportation Research Information Services (TRIS) and OECD's Joint Transport Research Centre's International Transport Research Documentation (ITRD) Database. FTA research reports, in addition to being hosted on DOT's research hub, are also accessible in TRID.

Coordinating with partners helps to extend research, builds on previous research findings, ensures a multi-modal focus, reduces duplication, and gathers information on research needs to help focus FTA's research project selection.



## 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
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



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