



# FTA Annual Report on Public Transportation Innovation Research Projects for Fiscal Year 2021



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*

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# FTA Annual Report on Public Transportation Innovation Research Projects for Fiscal Year 2021

**FEBRUARY 2022**

FTA Report No. 0210

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
<b>LENGTH</b>				
<b>in</b>	inches	25.4	millimeters	mm
<b>ft</b>	feet	0.305	meters	m
<b>yd</b>	yards	0.914	meters	m
<b>mi</b>	miles	1.61	kilometers	km
<b>VOLUME</b>				
<b>fl oz</b>	fluid ounces	29.57	milliliters	mL
<b>gal</b>	gallons	3.785	liters	L
<b>ft<sup>3</sup></b>	cubic feet	0.028	cubic meters	m <sup>3</sup>
<b>yd<sup>3</sup></b>	cubic yards	0.765	cubic meters	m <sup>3</sup>
NOTE: volumes greater than 1000 L shall be shown in m <sup>3</sup>				
<b>MASS</b>				
<b>oz</b>	ounces	28.35	grams	g
<b>lb</b>	pounds	0.454	kilograms	kg
<b>T</b>	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
<b>TEMPERATURE (exact degrees)</b>				
<b>°F</b>	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C

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14. ABSTRACT This report provides information on projects funded under Federal Public Transportation Law (49 U.S.C. § 5312). FTA research priorities are safety, mobility innovation, and infrastructure. Projects in these areas promote public transportation innovation to improve operations, infrastructure, and traveler experiences. Projects active in FY 2021 promoted research, innovation and development, demonstration and deployment, and evaluation.					
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U.S. Department  
of Transportation

**Federal Transit  
Administration**

Administrator

1200 New Jersey Avenue, SE  
Washington, DC 20590

February 4, 2022

Dear Colleague:

I am pleased to provide the Federal Transit Administration (FTA) Annual Report on Public Transportation Innovation Research for Fiscal Year (FY) 2021. This report provides information on FTA's research activities that received assistance under the Public Transportation Innovation Program (49 U.S.C § 5312) during FY 2021. Under this program, FTA funds projects of national significance that improve public transportation.

In FY 2021, FTA managed a research portfolio of approximately \$205 million, appropriated over multiple years. FTA's research priorities of safety, mobility innovation, and infrastructure align with the Department of Transportation's strategic goals of safety, climate and sustainability, equity, economic strength and modernization, transformation, and organizational excellence.

Of the \$205 million, \$54 million is allocated for safety research; \$48 million is allocated for mobility innovation research; \$32 million is allocated for infrastructure research; and \$12 million is allocated for supportive services and other activities such as the Transportation Cooperative Research Program and the Small Business Innovative Research Program. FY 2021 was an active year as FTA released over \$60 million for competitive research programs to improve safety, address COVID-19 issues, expand mobility, advance integrated payment systems, assess automation solutions, and field real-time asset management advanced technologies. As we look to the future, we will seek to fund additional innovative research in climate change, worker and rider safety, automation, public transit data-analytics, and the use of advanced modeling and simulation methods and leveraging technologies such as artificial intelligence to address economic strength and modernization of public transportation fleets.

Thank you for your continued support of FTA's Public Transportation Innovation Program. 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 that reads "Nuria I. Fernandez".

Nuria I. Fernandez

## Executive Summary

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

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

**Figure 1** FTA Pipeline Phased Approach



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

The strategic research areas for FTA in FY 2021 were Safety, Mobility Innovation, and Infrastructure. These areas facilitated equitable, accessible mobility, supported the deployment of environmentally sustainable systems, and enabled a safe and secure public transit system. Each program area supported the U.S. Department of Transportation's (DOT) strategic goals to ensure safety, climate and sustainability, equity, economic strength and modernization, transformation, and organizational excellence with the following specific objectives:

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

In FY 2021, FTA actively managed \$205 million in research funding. These funds are from multiple fiscal years and include \$54 million for safety research, \$48 million for mobility innovation research, \$32 million for infrastructure research, and \$12 million for supportive services and other activities such as the \$5 million Transportation Cooperative Research Program (TCRP) and the Small Business Innovation Program. FTA also continued to manage the Low or No (LoNo) Emission Vehicle Deployment Program primarily through FTA regional offices as a capital program. Most of these projects under the LoNo Emission Vehicle Deployment Program (\$59 million remaining) are in their final stages and preparing for project closure. In FY 2016, this area became a statutory program called the Low and No Emission Bus Program (49 U.S.C. § 5339(c)).

In FY 2021, FTA released over \$60 million for competitive research programs to improve safety, address COVID-19 issues, expand mobility, further integrate payment systems, assess automation solutions, and field advanced real-time asset management technologies. From a safety perspective, recent research and demonstration projects provided the transit industry with innovative tools and practices (such as track worker warning systems) to operate transit systems in a safer manner and with an improved safety culture. Mobility innovation research leveraged new technologies and operational methods to promote seamless travel and more mobility options for all travelers, including travelers with disabilities, travelers from rural areas, and lower income travelers. Infrastructure research launched efforts to use advanced technologies for asset management.

Table 1 provides a complete list of all FTA research programs and projects that received assistance in FY 2021, with projects categorized by research priority area and type of project. Figure 2 shows the location of FTA Research programs and projects by DOT research priority area.

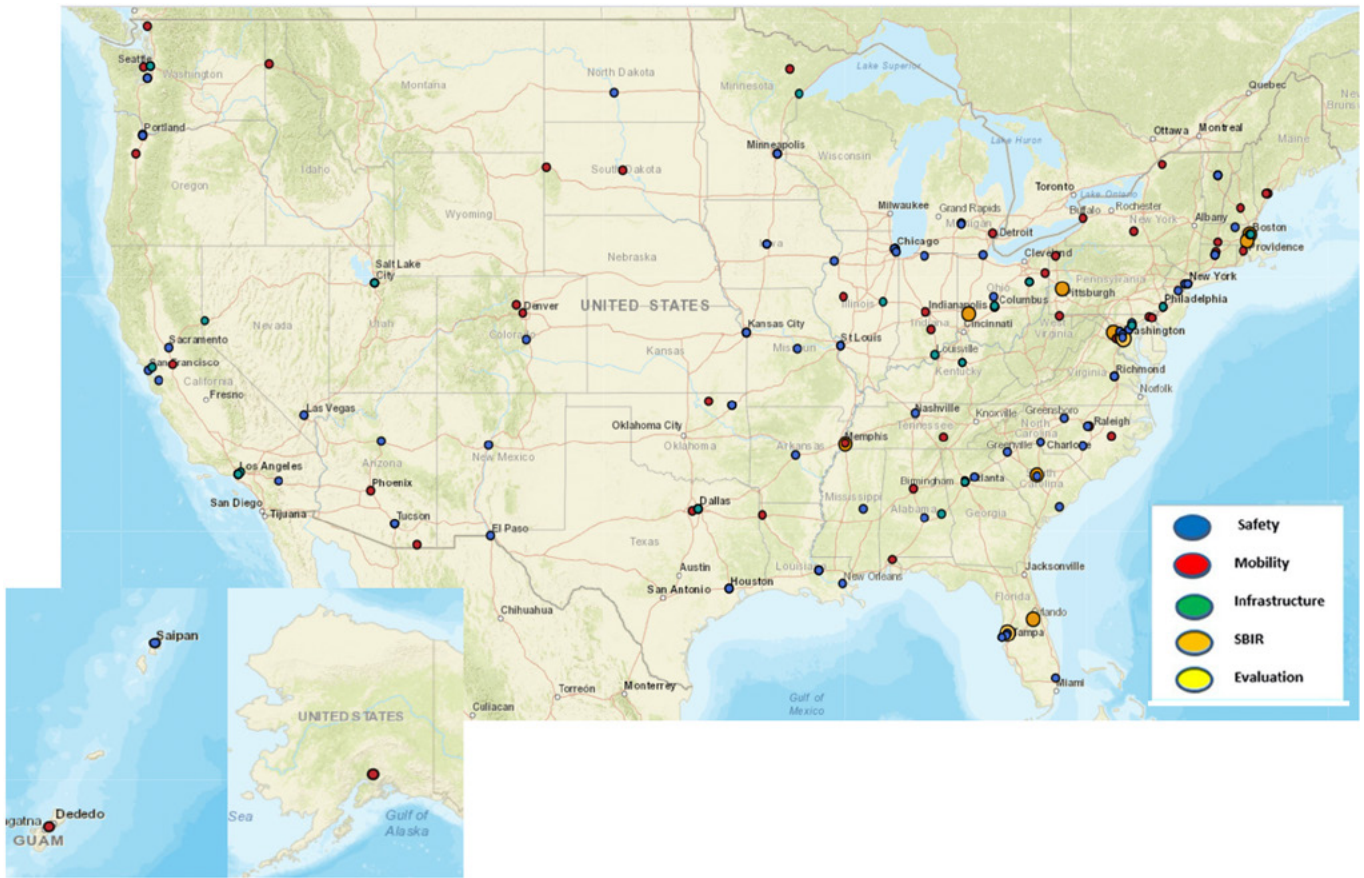
**Table 1** Complete List of FY 2021 Active FTA Research Programs and Projects

Research Priority	Type of Project	Project Title	FTA Funding
Safety	Demonstration & Deployment	Public Transportation COVID-19 Research Demonstration Grant Program	\$15,780,056
Safety	Demonstration & Deployment	Innovations in Transit Public Safety Projects	\$3,362,874
Safety	Demonstration & Deployment	Redesign of Transit Bus Operator Compartment to Improve Safety, Operational Efficiency, and Passenger Accessibility (Bus Operator Compartment) Program	\$1,600,000
Safety	Demonstration & Deployment	FY 2020 Safety Research and Demonstration (SRD) Program	\$7,513,656
Safety	Evaluation & Implementation	FY 2020 Safety Research and Demonstration (SRD) Program Evaluation	\$700,000
Safety	Demonstration & Deployment	FY 2020 Safety Research and Demonstration (SRD) Program	\$8,516,669
Safety	Evaluation & Implementation	FY 2020 Safety Research and Demonstration (SRD) Program	\$750,000
Safety	Demonstration & Deployment	Innovative Safety, Resiliency, and All-Hazards Emergency Response and Recovery (SRER) Program	\$13,067,589
Safety	Innovation & Development	FTA Employee Safety Reporting Pilot Program	\$2,972,141
Mobility Innovation	Demonstration & Deployment	Accelerating Innovative Mobility (AIM) Program	\$14,000,000
Mobility Innovation	Demonstration & Deployment	Integrated Mobility Innovation (IMI)	\$20,035,227

Research Priority	Type of Project	Project Title	FTA Funding
Mobility Innovation	Evaluation & Implementation	Mobility Innovation Demonstration Programs Evaluation	\$3,050,000
Mobility Innovation	Innovation & Development	Mobility on Demand (MOD) Sandbox	\$3,626,080
Mobility Innovation	Evaluation & Implementation	Mobility on Demand (MOD) Sandbox Evaluation	\$250,000
Mobility Innovation	Innovation & Development	Mobility on Demand (MOD) Metrics and Studies	\$750,000
Mobility Innovation	Research	Transit Automation Analysis and Research Plan Development	\$950,000
Mobility Innovation	Research	Strategic Transit Automation Research (STAR) Plan Enabling Research and Implementation	\$350,000
Mobility Innovation	Research	Transit Bus Automation Strategic Partnerships	\$600,000
Mobility Innovation	Evaluation & Implementation	Innovative Technology and Mobility Solutions Project Evaluation	\$300,000
Mobility Innovation	Research	Synthesis of Real Time Public Transit Route Deviation Operational Policies	\$59,202
Mobility Innovation	Research	Rides to Wellness Initiative	\$1,539,377
Mobility Innovation	Demonstration & Deployment	Human Services Coordination Research (HSCR) Deployment Program	\$2,207,857
Mobility Innovation	Research	Transit Cost and Delivery Project	\$469,565
Infrastructure	Research	Low or No (LoNo) Emission Component Assessment Program (LoNo-CAP)	\$15,000,000
Infrastructure	Innovation & Development	Low or No (LoNo) Emission Bus Testing Centers	\$11,000,000
Infrastructure	Demonstration & Deployment	Track Asset Management Demonstration	\$4,225,000
Infrastructure	Research	Use Cases for Unmanned Aircraft Systems (UAS) in Public Transportation Systems	\$140,000
Infrastructure	Research	Transit Vehicle Innovation Deployment Centers (TVIDC)	\$1,375,000
Supporting Programs	Research	Transit Cooperative Research Program (TCRP)	\$5,000,000
Supporting Programs	Innovative Development	Small Business Innovation (SBIR)	\$2,588,696
Supporting Programs	Evaluation & Implementation	Information Dissemination and Evaluation Program	\$1,439,692
Supporting Programs	Innovation & Development	Energy Efficient Mobility Systems Program	\$1,000,000
Supporting Programs	Evaluation & Implementation	Information Dissemination and Outreach Program	\$1,100,000
Supporting Programs	Evaluation & Implementation	Research Evaluation Implementation Plan	\$480,000
Supporting Programs	Innovation & Development	Transit Data Research Project Secure Data Commons System	\$100,000
Supporting Programs	Innovation & Development	Potential Uses of Advanced Data Science Methods in Transit Planning and Operations	\$200,000
<b>Total</b>			<b>\$146,098,681</b>
Infrastructure	Demonstration & Deployment	Low or No (LoNo) Emission Vehicle Deployment Program*	(\$58,473,758)
<b>Total</b>			<b>\$204,572,439</b>

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

Figure 2 Location of FTA Research Programs and 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.

## Program and Project Descriptions

This section of the report includes detailed descriptions of programs and projects that received FTA assistance in FY 2021. Definitions of assistance include the planning and development of a new project, the award of a new project, management of an existing project, or evaluation of a project. Program and project descriptions are categorized by research priority area in FY 2021—Safety, Mobility Innovation, and Infrastructure—and conclude with a section on supporting programs and other initiatives. Individual program and project descriptions include title, recipient(s), performance indicators (results), evaluation, and FTA funding.

### Safety

#### Description:

FTA's Safety research 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. FTA supported research on technologies and practices to reduce fatalities and injuries, improve safety culture, identify hazards and risk, and assess processes that help transit agencies operate public systems in a safer manner.

#### Objectives:

The FTA Safety research program sought to:

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

FTA had nine active Safety programs and projects in FY 2021, as listed in Table 2.

**Table 2** *Safety Research Programs and Projects Receiving Assistance from FTA, FY 2021*

Safety Programs		
Type of Project	Project Title	FTA Funding
Demonstration & Deployment	Public Transportation COVID-19 Research Demonstration Grant Program	\$15,780,056
Demonstration & Deployment	Innovations in Transit Public Safety Projects	\$3,362,874
Demonstration & Deployment	Redesign of Transit Bus Operator Compartment to Improve Safety, Operational Efficiency, and Passenger Accessibility (Bus Operator Compartment) Program	\$1,600,000
Demonstration & Deployment	FY 2020 Safety Research and Demonstration (SRD) Program	\$7,513,656
Evaluation & Implementation	FY 2020 Safety Research and Demonstration (SRD) Program Evaluation	\$700,000
Demonstration & Deployment	FY 2016 Safety Research and Demonstration (SRD) Program	\$8,516,669
Evaluation & Implementation	FY 2016 Safety Research and Demonstration (SRD) Program Evaluation	\$750,000
Demonstration & Deployment	Innovative Safety, Resiliency, and All-Hazards Emergency Response and Recovery (SRER) Program	\$13,067,589
Innovation & Development	FTA Employee Safety Reporting Pilot Program	\$2,972,141
<b>Total</b>		<b>\$54,262,985</b>

**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:**

FTA announced project selections on January 19, 2021 of approximately \$15.8 million. FTA awarded 28 of the 37 cooperative agreements to recipients and their project teams in FY 2021, and work is underway. Cooperative agreements for the remaining projects were delayed due to resource issues but are expected to be awarded and underway in early FY2022.

**Project/Program Evaluation:**

The program will have an independent evaluation as statutorily required.

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



**Table 3 COVID-19 Research Demonstration Grant Projects Receiving Assistance from FTA, FY 2021**

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
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	\$122,637
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 Government	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

Project Title	Project Recipient	City and State	FTA Award
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
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 Transit	Seattle, WA	\$400,000
<b>Total</b>			<b>\$15,780,056</b>

### **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:**

FTA executed 15 of 21 cooperative agreements in FY 2021 and will execute the remaining cooperative agreements in FY 2022. Each project will develop tools, techniques, and/or processes to prevent human trafficking and reduce crime on public transit vehicles and in facilities.

**FTA Funding:** \$3,362,874

**Table 4** *Innovations in Transit Public Safety Projects Receiving Assistance from FTA, FY 2021*

Project Title	Project Recipient	City and State	FTA Award
Mountain Line 5312 Transit Innovations FY2021 - 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
Pinellas Suncoast Transit Authority, Inc. (PSTA) 5312 FY 2019 Innovation in Transit Public Safety Grant	Pinellas Sound Coast Transit	St. Petersburg, FL	\$43,630
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
Innovation in Transit Public Safety – Human Trafficking Prevention	Toledo Area Regional Transit Authority	Toledo, OH	\$474,232
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
Eliminating the Blind Spots on Human Trafficking	Greenville Transit Authority	Greenville, SC	\$20,937

Project Title	Project Recipient	City and State	FTA Award
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 (FY19 Innovations in Transit Public Safety)	Metropolitan Transit Authority of Harris County	Houston, TX	\$160,000
		<b>Total</b>	<b>\$3,362,874</b>

**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:**

In FY 2021, International Transportation Learning Center submitted the literature review report titled *Redesign of Transit Bus Operator Compartment to Improve Safety, Operational Efficiency, and Passenger Accessibility*, and New Orleans Regional Transit Authority submitted a report titled *Analysis of Assault/Crime Data on Regional Transit Authority Vehicles and Relevant Operational Practices, Procedures, and Training*. These internal reports provided information to guide future research.

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

**Table 5** *Redesign of Transit Bus Operator Compartment to Improve Safety, Operational Efficiency, and Passenger Accessibility (Bus Operator Compartment) Active Projects in FY 2021*

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
		<b>Total</b>	<b>\$1,600,000</b>

**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:**

Project selections were announced on October 8, 2020. FTA awarded all eight cooperative agreements with statements of work to recipients and their project teams by July 2021. The projects are beginning work to support their respective goals and objectives.

**Project/Program Evaluation:**

This demonstration program will have an independent evaluation with an Interim Evaluation Report within two years of the awards, and a final evaluation report upon completion of all projects.

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

**Table 6** FY 2020 Safety Research and Demonstration (SRD) Active Projects in FY 2021

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

## **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 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:**

The independent evaluation for these programs is in the process of being planned. In FY 2021, CUTR worked with FTA to review the data management plans submitted by each of the project teams to ensure that the proposed data set collection by each project team will be relevant and available to FTA and the evaluation team.

**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:**

In FY 2021, recipients of funding under the FY 2016 SRD Program completed activities that met the program goals. Examples include the calibration of sensors and the validation of the communication network on the secondary track worker protection system by the Maryland Transit Administration's (MTA). MTA also completed the installation of all relevant train detection units on the light rail system. In addition, the Sacramento Regional Transit District (SacRT) and their technology vendor completed the hardware and software deployment, test, and validation. In February 2021, FTA posted the final report prepared by SacRT titled *Roadway Worker Protection Secondary Warning Device*

and Employee in Charge Software System (EICSS) accessible at <https://rosap.ntl.bts.gov/view/dot/54943>. The remaining projects under the program are in the demonstration and evaluation phases and are drafting the final reports.

**FTA Funding:** \$8,516,669

**Table 7** FY 2016 SRD Projects Receiving Assistance from FTA in FY 2021

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

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

**Results:**

In FY 2021, FTA and CUTR worked with each recipient to collect lessons learned, analyze data generated by the projects, review final reports, assist with knowledge transfer activities, and conduct project close-out interviews on the projects that are completed. FTA posted the *2016 Safety Research Demonstration (SRD) Independent Evaluation, Interim Report* (<https://rosap.ntl.bts.gov/view/dot/49551>) in May 2020. The information in the interim report will be updated and finalized in the final evaluation report, after all eight projects of the program are completed.

**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:**

In FY 2021, FTA published the following reports:

- *Wayside Worker Protection Technology—TrackSafe Phase II Research & Demonstration* (<https://rosap.ntl.bts.gov/view/dot/56189>) by the Metropolitan Atlanta Rapid Transit Authority (MARTA)
- *Platform Track Intrusion Detection System Evaluation for Los Angeles County Metropolitan Transportation Authority* (<https://rosap.ntl.bts.gov/view/dot/55686>)

The remaining four projects under the program are in the demonstration and evaluation phases and are drafting the final reports. The results of these projects, as noted in the above reports, enable transit agencies to incorporate lessons learned from the demonstration projects into their own efforts to improve safety, resiliency to natural disasters, and emergency response.

**Project/Program Evaluation:**

Each project report contains its independent evaluation as an appendix.

**FTA Funding:** \$13,067,589

**Table 8** *Innovative Safety, Resiliency, and All-Hazards Emergency Response and Recovery (SRER) Research Demonstration Projects Receiving Assistance from FTA, FY 2021*

Project Title	Project Recipient	City and State	FTA Award
Demonstration and Commercialization of LRV Bumper for Enhanced Safety in Shared Right-of-Way Street Environments	Applied Research Associates	Albuquerque, NM	\$1,323,414
Wayside Worker Protection Demonstration Project	Metropolitan Atlanta Rapid Transit Authority	Atlanta, GA	\$4,233,865
Coordinated Transit Response Planning and Operations Support Tools for Mitigating Impacts of All-Hazards Emergency Events	University of Chicago	Chicago, IL	\$2,890,600
Evacuation and Return: Increasing Safety and Reducing Risk	City of New Orleans	New Orleans, LA	\$500,329



Project Title	Project Recipient	City and State	FTA Award
Innovative Platform Track Intrusion Detection System Technology: A Demonstration on Los Angeles Metro Rail System	Los Angeles County Metropolitan Transportation Authority	Los Angeles, CA	\$1,722,400
Resilient Concrete Crosstie and Fastening System Designs for Light Rail, Heavy Rail, and Commuter Rail Transit Infrastructure	University of Illinois	Urbana, IL	\$2,396,981
<b>Total</b>			<b>\$13,067,589</b>

**Title: *FTA Employee Safety Reporting Pilot (ESRP) Program***

**Recipient:** The Volpe Center

**Project Description:**

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

**Results:**

The program concluded in March 2021. The program completed internal guidance documents titled *Industry Baseline Study and the Initial Impressions Interviews Briefing*. FTA hosted a webinar under this program to help transit agencies understand ESRP requirements, and FTA presented on the ESRP PTASP requirements at the FTA-sponsored Joint State Safety Oversight Agency and Rail Transit Agency Workshop (attended by 282 individuals). The internal guidance documents, the webinar, and the workshop offered best practices and suggested approaches, methodologies, and ideas to consider when designing and implementing an effective ESRP.

**FTA Funding:** \$2,972,141

# Mobility Innovation

## Description:

FTA’s Mobility Innovation research program continued to strengthen the capacity of transit agencies and communities to navigate the dynamic, evolving landscape of personal mobility. FTA leveraged emerging and innovative 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, 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 2021, as shown in Table 9.

**Table 9** *Mobility Innovation Programs Receiving Assistance from FTA, FY 2021*

Mobility Innovation Programs		
Type of Project	Project Title	FTA Funding
Demonstration & Deployment	Accelerating Innovative Mobility (AIM) Program	\$14,000,000
Demonstration & Deployment	Integrated Mobility Innovation (IMI) Demonstration Program	\$20,035,227
Evaluation & Implementation	Mobility Innovation Demonstration Programs Evaluation	\$3,050,000
Innovation & Development	Mobility on Demand (MOD) Sandbox	\$3,626,080
Evaluation & Implementation	Mobility on Demand (MOD) Sandbox Evaluation	\$250,000
Innovation & Development	Mobility on Demand (MOD) Metrics and Studies	\$750,000
Research	Transit Automation Analysis and Research Plan Development	\$950,000
Research	Strategic Transit Automation Research (STAR) Plan Enabling Research and Implementation	\$350,000
Research	Transit Bus Automation Strategic Partnerships	\$600,000
Evaluation & Implementation	Innovative Technology and Mobility Solutions Project Evaluation	\$300,000
Research	Synthesis of Real Time Public Transit Route Deviation Operational Policies	\$59,202
Research	Rides to Wellness Initiative	\$1,539,377
Demonstration & Deployment	Human Services Coordination Research (HSCR) Deployment Program	\$2,207,857
Research	Transit Cost and Delivery Project	\$469,565
<b>Total</b>		<b>\$48,187,308</b>

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

**Recipients:** Transit authorities, state and local governments, and state DOTs in partnership with other transit providers (see Table 10)

**Project Description:**

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

**Results:**

FTA awarded 23 of the 25 cooperative agreements in FY 2021. Several projects completed project planning activities and are in the demonstration phase. The AIM grants will help transit agencies explore new service models that provide more efficient service. They will assist FTA’s ongoing effort to drive innovative transit technologies and practices that encourage travelers to choose public transportation, promote economic development in communities, and enhance mobility for all.

**Project/Program Evaluation:**

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

**FTA Funding:** \$14,000,000

**Table 10 Accelerating Innovative Mobility (AIM) Projects Receiving Assistance from FTA, FY 2021**

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

Project Title	Project Recipient	City and State	FTA Award
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
Mobility Multi-Mode Transit App	The City of Highland Park	Highland Park, IL	\$225,500
Southern Minnesota Mobility as a Service (MaaS) Platform	Minnesota Department of Transportation	St. Paul, MN	\$628,000
Cost-Effective Advanced Driver Assistance System (ADAS) to Ensure ADA-Compliant Level Boarding for Bus Rapid Transit	Kansas City Area Transportation Authority	Kansas City, MO	\$600,000
Transforming Public Transit in Wilson with Rural On-Demand Microtransit	City of Wilson	Wilson, NC	\$250,000
Beyond Verification & Validation (V&V) for CBTC/UWB Systems	Metropolitan Transit Authority (MTA)	New York City, NY	\$180,000
Enhancing Life with Automated Transportation for Everyone (ELATE)	Western Reserve Transit Authority	Youngstown, OH	\$2,331,000
Near Real-Time Large Transit Network Reporting System	Oregon Department of Transportation	Portland, OR	\$480,000
Advancing Geofencing Functionality	Rhode Island Public Transit Authority	Providence, RI	\$244,000
AI based Smart Dispatch for Dynamic Data-Driven Micro-Transit Service	West River Transit Authority d/b/a Prairie Hills Transit	Spearfish, SD	\$308,912
Memphis Integrated Mobility Framework	Memphis Area Transit Authority	Memphis, TN	\$483,000
Transit First/Last Mile Solution: The EZ Zeus, a Zero- emission, Level 4, FMVSS, ADA, and Buy America-compliant Automated Shuttle Bus	Metropolitan Transit Authority of Harris County (Houston METRO)	Houston, TX	\$1,473,435
Electric Fast Foil Ferry: Re-imagining the Mosquito Fleet for Accelerating Passenger Ferry Innovation	Kitsap County Public Transportation Benefit Area	Bremerton, WA	\$372,910
Seamless Transportation Services for the Greater Morgantown Area	Monongalia Urban Mass Transit Authority dba Mountain Line Transit	Morgantown, WV	\$40,000
<b>Total</b>			<b>\$14,000,000</b>

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

**Recipients:** Transit authorities partnering with local governments, educational institutions, and private entities (see Table 11)

**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:**

FTA awarded 24 IMI projects in FY 2021. All projects have started their demonstration activities. The projects will advance mobility through creative partnerships and emerging technologies. Combining public and private transportation assets and strategies can greatly increase access to mobility for everyone.

**Evaluation:**

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

**FTA Funding:** \$20,035,227

**Table 11** *Integrated Mobility Innovation (IMI) Projects Receiving Assistance from FTA, FY 2021*

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
Baldwin County's Integrated Mobility Innovation (IMI)	Baldwin County Commission	Bay Minette, AL	\$260,800
Developing standardized mobility payment integration and institutional capacity for rural Mobility as a Service	San Joaquin Regional Transit District	San Joaquin, CA	\$306,000
On-Demand Human Services Transportation for Older Adults, People with Disabilities, and Low-Income Individuals	City of Boulder	Boulder, CO	\$224,000
Testing and Deployment of Automated Buses on Connecticut Fastrak	Connecticut Department of Transportation	Hartford, CT	\$2,000,000
Greater Hartford Program for Innovative Mobility	Greater Hartford Transit District	Hartford, CT	\$630,000
Atlanta-Region Rider Information and Data Evaluation System (ATL RIDES)	Georgia Regional Transportation Authority for Atlanta-Region Transit Link Authority (ATL)	Atlanta, GA	\$430,400

Project Title	Project Recipient	City and State	FTA Award
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
Innovative Mobility Project for Arrowhead Community Transportation (IMPACT)	Arrowhead Economic Opportunity Agency	Duluth, MN	\$952,807
Northeastern Wake County Rural Microtransit Service	Wake County Human Services	Raleigh, NC	\$393,527
Tompkins Mobility-as-a-Service (MaaS) Phase I	Tompkins County	Ithaca, NY	\$820,000
Regional Cloud-Based Traffic Management Artificial Intelligence System to Improve Transit Travel Times and Enhance Mobility on Demand Services	Central Ohio Transit Authority	Columbus, OH	\$1,725,000
EZfare: The Gateway	Stark Area Regional Transit Authority (SARTA)	Canton, OH	\$1,997,503
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>\$20,035,227</b>

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

**Recipients:** ICF International

**Project Description:**

This project supports FTA’s IMI and AIM Programs and meets the statutory requirement of independent research demonstration evaluation under 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 2021, the independent evaluator distributed a quick reference guide and pre-engagement questionnaire to all 24 IMI and 25 AIM projects. The quick reference guide outlined the steps in the independent evaluation process, and the questionnaire was produced to help structure the evaluation plan for each IMI and AIM recipient. The independent evaluator also finalized evaluations plans for two IMI recipients, Baldwin County Commission and the Michigan Department of Transportation. FTA and the independent evaluator are working with the other grant recipients' projects in holding initial engagement meetings and finalizing evaluation plans.

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

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

**Recipient:** Transit authorities, local governments, non-profit organizations, and private entities (see Table 12)

**Project Description:**

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

**Results:**

In FY 2021, FTA published the following MOD Sandbox demonstration project reports:

- *Mobility on Demand (MOD) Sandbox Demonstration: Tri-County Metropolitan Transportation District of Oregon (TriMet) OpenTripPlanner (OTP) Shared-Use Mobility, Final Report* (<https://rosap.ntl.bts.gov/view/dot/56479>)
- *Mobility on Demand (MOD) Sandbox Demonstration: Valley Metro Mobility Platform, Final Report* (<https://rosap.ntl.bts.gov/view/dot/55687>)
- *Mobility on Demand Sandbox Demonstration: Puget Sound First/Last Mile Partnership with Via, Final Report* (<https://rosap.ntl.bts.gov/view/dot/55688>)
- *Mobility on Demand (MOD) Sandbox Demonstration: Limited Access Connections* (<https://rosap.ntl.bts.gov/view/dot/55691>)

The remaining projects under the program are in the demonstration and evaluation phases and are drafting the final reports. The Sandbox set a new tone for the industry, supportive of innovation, willing to take risks, and focused on people. The public transportation agencies around the country adapted the

examples set forth by the MOD Program. What in 2016 was called innovative is now increasingly commonplace.

**FTA Funding:** \$3,626,080

**Table 12** *Mobility on Demand (MOD) Projects Receiving Assistance from FTA, FY 2021*

Project Title	Project Recipient	City and State	FTA Award
MOD Sandbox: Adaptive Mobility with Reliability and Efficiency	Regional Transportation Authority of Pima County	Tucson, AZ	\$669,158
MOD Sandbox: Mobility Platform	Valley Metro Rail, Inc.	Phoenix, AZ	\$1,001,000
MOD Sandbox: Los Angeles County and Puget Sound MOD Partnership	Los Angeles County Metropolitan Transportation Authority	Los Angeles, CA	\$1,350,000
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
<b>Total</b>			<b>\$3,626,080</b>

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

**Recipient:** ICF International

**Project Description:**

The purpose of this evaluation is to conduct a comprehensive independent evaluation of the MOD Sandbox demonstrations. The independent evaluation is required by 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:**

In FY 2021, FTA published four MOD Sandbox demonstration evaluation reports:

- *Mobility on Demand (MOD) Sandbox Demonstration: Chicago Transit Authority (CTA) Ventra–Divvy Integration Case Study* (<https://rosap.ntl.bts.gov/view/dot/56482>)
- *Mobility on Demand (MOD) Sandbox Demonstration: Dallas Area Rapid Transit (DART) First and Last Mile Solution Evaluation Report* (<https://rosap.ntl.bts.gov/view/dot/56483>)
- *Mobility on Demand (MOD) Sandbox Demonstration: Vermont Agency of Transportation (VTrans) OpenTripPlanner, Evaluation Report* (<https://rosap.ntl.bts.gov/view/dot/57992>)
- *Mobility on Demand (MOD) Sandbox Demonstration: Valley Metro Mobility Platform, Evaluation Report* (<https://rosap.ntl.bts.gov/view/dot/57599>).

ICF International is completing the last evaluation reports. Results from the evaluation advanced public transportation in the US by identifying impacts and benefits of MOD alternative transportation services. The evaluations apply lessons learned for other transportation providers interested in adopting these MOD services.

**FTA Funding:** \$250,000



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

**Recipient:** TransitCenter, Inc.

### **Project Description:**

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

### **Results:**

This project concluded in July 2021. It developed a five-phase approach to mobility performance measurement strategy and metric development with a continuous feedback loop for refinement of deployment process. The project developed internal and external documents and published the *Mobility Performance Metrics (MPM) for Integrated Mobility and Beyond* report, accessible at <https://rosap.ntl.bts.gov/view/dot/44117>, which presents traveler-centric mobility performance strategies and metrics and the approach for the development of those metrics. Overall, the project examined how transit agencies can reorient their approach to meeting their objectives and goals using consistent MOD performance measures.

**FTA Funding:** \$750,000

## **Title: *Transit Automation Analysis and Research Plan Development***

**Recipient:** The Volpe Center

### **Project Description:**

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

### **Results:**

This project concluded in June 2021. Under this project, FTA published the *Insurance and Liability for Automated Transit Buses: State of the Practice Review* (<https://rosap.ntl.bts.gov/view/dot/55462>), and the *Transit Bus Automation: State and Local Policy Scan* (<https://rosap.ntl.bts.gov/view/dot/49129>). The Volpe Center conducted research on potential issues concerning Mass Transit Employee Protections (49 USC § 5333(b)) and transit bus automation. The research led to an internal FTA document. The project also conducted literature reviews and research on Federal rules, regulations, and statutes that provide

challenges and barriers to the implementation of transit bus automation. These activities addressed the STAR Plan goal of identifying and resolving barriers to deployment of transit automation.

**FTA Funding:** \$950,000

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

**Recipient:** The Volpe Center

**Project Description:**

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

**Results:**

In FY 2021, the Volpe Center conducted a market analysis for automated transit buses and supporting systems. The findings were documented in the Assessing Transit Providers' Internal Business Case for Transit Bus Automation (<https://rosap.ntl.bts.gov/view/dot/55463>) and the Survey Research for Automated Shuttle Pilots: Issues and Challenges (<https://rosap.ntl.bts.gov/view/dot/56188>) reports. The information and results from these activities assist and encourage the transit industry in adopting automation in an informed and coordinated manner by providing an understanding of the automation market and articulating the benefits.

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

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

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

**Project Description:**

The purpose of the 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 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 2021, CUTR finalized and FTA published the following documents:

- *An Evaluation of the Valley Metro–Waymo Automated Vehicle RideChoice Mobility on Demand Demonstration, Final Report* (<https://www.transit.dot.gov/sites/fta.dot.gov/files/2021-09/FTA-Report-No-0198%20REVISED.pdf>)
- Valley Metro fact sheet (<https://www.transit.dot.gov/research-innovation/fta-transit-bus-automation-factsheet-valley-metro>)
- Access Services fact sheet (<https://www.transit.dot.gov/research-innovation/fta-transit-bus-automation-factsheet-access-services>)
- Port Authority of New York and New Jersey fact sheet (<https://www.transit.dot.gov/research-innovation/fta-transit-bus-automation-factsheet-port-authority-new-york-and-new-jersey>)

The report and the fact sheets disseminate their research findings of organizations conducting research on transit bus automation.

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

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

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

**Project Description:**

The project assists in the evaluation of thirteen projects funded through the Michigan Mobility Challenge (MMC). The MMC 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 July 2021, MDOT held a stakeholders’ meeting with all MMC project recipients. The meeting was a forum to deliver project updates, including challenges and lessons learned, such as the COVID-19 pandemic’s impact on projects.

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

### **Title: *Synthesis of Real-Time Public Transit Route Deviation Operational Policies***

**Recipients:** New York University

**Project Description:**

This project examined the issue of transit agencies’ struggles to accelerate the deployment of new and more cost-effective technologies as well as understand how to adapt operations more readily to rider demands within current constraints. The goal for this project was to gain an understanding of the benefits of real-time adaptive adjustments of public transit service (mainly bus service) and how it can be achieved.

**Results:**

This project concluded in January 2021. New York University examined the issue of transit agencies' struggles to accelerate the deployment of new and more cost-effective technologies. It also examined how to adapt operations more readily to rider demands. The project produced a final report titled *Spectrum of Public Transit Operations: From Fixed Route to Microtransit* (<https://c2smart.engineering.nyu.edu/wp-content/uploads/2020/04/Chow-FTA-Report-NY-2019-069-01-00.pdf>), published as a Connected Cities with Smart Transportation (C2SMART) document. FTA references the report as a resource in relation to current and potential new activities.

**FTA Funding:** \$59,202

**Title: *Rides to Wellness Initiative***

**Recipients:** Competitively selected Transit and Health Access demonstration recipients (see Table 13)

**Project Description:**

The Rides to Wellness Initiative built partnerships, stimulated investment, and drove change across the health and transportation sectors to ensure that everyone can reach the health services they need. It was associated with the Coordinated Council on Access and Mobility (CCAM), a Federal interagency council established by Executive Order 13330. The primary purpose of the initiative is to test promising, replicable public transportation healthcare access solutions. The goals were to 1) increase access to healthcare; 2) improve health outcomes; and 3) reduce healthcare costs. The selected projects are diverse, piloting innovative concepts from assessing new technology innovations to determining more efficient ways to schedule a ride.

**Results:**

The last three active projects closed in FY 2021, bringing the initiative to its conclusion. The eight projects raised awareness about the connection between transportation and healthcare and opened the door for partnerships to build upon the ideas and experiences of the program. Overall, program participants credit the projects with significant improvements to their health. Program participants reported they were more active and independent, had more control over their lives, experienced less emotional hardship, and were better able to reach their goals. The program was successful at identifying innovative public transportation solutions to healthcare access challenges.

**Project/Program Evaluation:**

FTA published the Rides to Wellness Demonstration Grants Program Evaluation (<https://rosap.ntl.bts.gov/view/dot/55685>) report in March 2021. This evaluation report included an overview of the Rides to Wellness Initiative, profiles of each demonstration project including project outcomes and lessons learned, and findings and recommendations.

**FTA Funding:** \$1,539,377

**Table 13** *Rides to Wellness Initiative Projects Receiving Assistance from FTA, FY 2021*

Project Title	Project Recipient	City and State	FTA Award
Delaware County Connections Program	Iowa Department of Transportation	Ames, IA	\$130,560
Gateway Program	Bi-State Development Agency	Saint Louis, MO	\$940,251
GO Buffalo Mom	Niagara Frontier Transportation Authority	Buffalo, NY	\$468,566
<b>Total</b>			<b>\$1,539,377</b>

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

**Recipients:** Transit authorities, local governments, non-profit organizations, and state DOTs (see Table 14)

**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.

**Results:**

Many of the HSCR grant recipients experienced delays due to the COVID-19 pandemic. As a result, FTA granted extensions to projects that were scheduled to be completed by December 2021. FTA also continued to work with grant recipients to start their projects during this reporting period.

**FTA Funding:** \$2,207,857

**Table 14** *Human Service Coordination Research (HSCR) Projects Receiving Assistance from FTA, FY 2021*

Project	Recipient	City and State	FTA Award
Central Alabama Transportation Resource Center	United Way of Central Alabama, Inc.	Birmingham, AL	\$148,000
Bridging Medical and Healthy Food Access with Transportation in Cochise County, Arizona	Southeastern Arizona Governments Organization	Bisbee, AZ	\$235,852
Alternative Senior Transportation Service using TNCs	County of Fulton	Atlanta, GA	\$243,778
Partners for Enhanced Access to Treatment (PEAT)	Community Action Partnership of Central Illinois	Lincoln, IL	\$40,000
City of Shreveport Paratransit Passenger Portal Project	City of Shreveport	Shreveport, LA	\$54,472
Enhancing Technology Resources for Increased Mobility Options	Maryland Transit Administration	Baltimore, MD	\$240,000

Project	Recipient	City and State	FTA Award
Mobility Solutions for Maine: Building a Multi-Sector Network to Drive Improved Coordination and Access	Greater Portland Council of Governments	Portland, ME	\$240,000
2-1-1 NH as NH's Simplified Ride Guide	New Hampshire Department of Transportation	Concord, NH	\$17,295
NJ Transit: Transportation for Everyone Videos	NJ Transit	Newark, NJ	\$60,600
Coordinated Volunteer Transportation in Western New York State	Volunteer Transportation Center, Inc.	Watertown, NY	\$145,968
Osage Nation HSCR Project – Increasing Access to Transportation for Targeted Populations	Osage Nation	Pawhuska, OK	\$73,892
Rides Toward Work	Rhode Island Public Transit Authority	Providence, RI	\$150,000
Human Services Transportation Assistance – Bus Purchase and Operating Assistance	Southeast Tennessee Human Resource Agency	Dunlap, TN	\$388,000
Recovery Rides – Access to Substance Abuse Treatment and Employment	Vermont Agency of Transportation	Montpelier, VT	\$170,000
<b>Total</b>			<b>\$2,207,857</b>

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

**Recipient:** The Eno Transportation Foundation, Inc.

#### **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 US. 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 US 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 plan and host a symposium on transit project delivery.

#### **Results:**

In July 29 2021, Eno released and published the foundational report *Saving Time and Making Cents: A Blueprint for Building Transit Better* (<https://projectdelivery.enotrans.org/wp-content/uploads/2021/07/Saving-Time-and-Making-Cents-A-Blueprint-for-Building-Transit-Better.pdf>). The report analyzes current and historical trends in public transit project delivery.

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

# Infrastructure

**Description:**

FTA has a successful history supporting transformative public transportation infrastructure research and demonstration projects to include those assets that are used to directly support and provide public transportation service. FTA 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.
- Use simulation and modeling to explore new energy technologies and innovative bus designs in partnership with the U.S. Department of Energy.

FTA had six active Infrastructure programs and projects in FY 2021, as shown in Table 15.

**Table 15** Infrastructure Programs Receiving Assistance from FTA, FY 2021

Infrastructure Programs		
Type of Project	Project Title	FTA Funding
Research	Low or No (LoNo) Emission Component Assessment Program (LoNo-CAP)	\$15,000,000
Innovation & Development	Low or No (LoNo) Emission Bus Testing Centers	\$11,000,000
Demonstration & Deployment	Track Asset Management Demonstration	\$4,225,000
Research	Use Cases for Unmanned Aircraft Systems (UAS) in Public Transportation Systems	\$140,000
Research	Transit Vehicle Innovation Deployment Centers (TVIDC)	\$1,375,000
Demonstration & Deployment	Low or No (LoNo) Emission Vehicle Deployment Program*	(\$58,473,758)
<b>Total</b>		<b>\$31,740,000</b>

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

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

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

**Project Description:**

The purpose of the two LoNo-CAP Centers, managed by 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 (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.

**Results:**

In FY 2021, Ohio State and Auburn conducted significant outreach to component and transit vehicle manufacturers to solicit testing opportunities, and some promising discussions were held. FTA continued to provide virtual program management and oversight support to Ohio State and Auburn to review project timelines and milestone project reports, assess issues or challenges, and address any other matters of concern such as funding eligibility requirements. The Centers’ continued collaboration with FTA and awareness-building with the industry should result in testing activities in the future. Additionally, FTA updated the statements of work for each Center to allow funding to be used for the purchase of capital testing equipment and other investments needed to operate the centers.

**FTA Funding:** \$15,000,000

**Table 16** *Low or No (LoNo) Emission Component Assessment Program (LoNo-CAP) Projects Receiving Assistance from FTA, FY 2021*

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
<b>Total</b>			<b>\$15,000,000</b>

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

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

**Project Description:**

The purpose of this appropriation was to expand the capabilities of the LoNo-CAP Centers to establish, operate, and maintain facilities to conduct testing of new low or no (LoNo) emission bus models.

**Results:**

Upon changes to the statutory language from the FY 2021 Appropriations Act, FTA amended the scope of work to allow unexpended funds from the LoNo-CAP program to be used to support suitable capital projects for building new infrastructure and enhance existing facilities to expand bus testing capability. FTA continued to work with both institutions when necessary to help them achieve milestones.

**FTA Funding:** \$11,000,000



**Table 17** *Low or No (LoNo) Emission Bus Testing Centers Receiving Assistance from FTA, FY 2021*

Project Title	Project Recipient	City and State	FTA Award
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
<b>Total</b>			<b>\$11,000,000</b>

**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 2021, MARTA Operations continued utilizing Phase 1 technologies installed in 2020, gathering and validating track inspection data from the Work Train monthly. The project also conducted and approved the final design review of ATIS Phase 2 technologies in May 2021. It was supplemented by a detailed structural analysis of a major beam component. ATIS Phase 2 technologies were procured, configured, and ready for installation on the structural beam for upcoming acceptance testing. This project is the first deployment of this technology on a transit system in the US. It is assisting track workers to find track anomalies in a real-time environment.

**Project/Program Evaluation:**

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

**FTA Funding:** \$4,225,000

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

**Recipient:** The Volpe Center

**Project Description:**

This program examined the utility of UAS technology in public transportation systems, focusing on two use cases permitted under current regulations— infrastructure inspection and disaster response and recovery. The application of commercial UAS technology to public transportation operations may offer benefits in both safety and efficiency. The goals of this program are to 1) assist public transportation systems in determining whether to apply UAS technology

to their operations; and 2) provide high-level guidance for the development of UAS programs by public transportation systems.

**Results:**

This project ended in December 2020. Under this project, the Volpe Center completed and FTA published the *Use Cases for Unmanned Aircraft Systems (UAS) in Public Transportation Systems* report (<https://rosap.ntl.bts.gov/view/dot/54600>). The report recommended applying UAS technology to public transportation systems in two areas: infrastructure inspection and disaster response and recovery. The findings examined each use case from three perspectives: 1) air traffic management (ATM) for implementing UAS operations; 2) human factors considerations; and 3) cost effectiveness analysis.

**FTA Funding:** \$140,000

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

**Recipients:** CALSTART, Inc.

**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 US 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 TVIDCs research the field and coordinate and disseminate information, including tech transfer education to the public transportation industry.

**Results:**

In FY 2021, CALSTART, Inc., completed and FTA published the report titled *Transit Vehicle Innovation Deployment Centers (TVIDC) Advisory Panel Overview and Conclusions* (<https://rosap.ntl.bts.gov/view/dot/55689>). The report summarized the Transit Vehicle Innovation Deployment Advisory Panel's suggestions to the challenges of innovation, development, and adoption of zero-emission transit technologies.

**FTA Funding:** \$1,375,000

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

**Recipient:** Transit authorities and project teams comprising transit agencies, systems experts, and bus manufacturers (see Table 18)

**Project Description:**

FTA's LoNo program began in 2013 as a program funded under 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 and create new jobs in US 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 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 49 U.S.C. § 5339 and funding increased to \$55M annually. This large competitive discretionary program is managed by FTA’s Office of Program Management and was renamed “Low-No.”

**Results:**

A number of key research activities are providing an important foundation to inform the future capabilities of LoNo Emission Vehicles. In March 2021, 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). In July 2021, 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. In September 2021, CTE submitted a final draft report to FTA covering the project performance and results for what began as the design and deployment of an ECOSaver Electric Fuel Cell bus at the Ohio State University Center for Automotive Research, which was later revised to provide The Ohio State University conducted an FCEB for demonstration on its campus. The remaining projects under the program are in the demonstration phase. This supporting research and evaluations of the demonstration projects are critical to advancing the technology, safety, and design of LoNo Emission Vehicles. The success of the LoNo Program has resulted in the program being authorized in the Bipartisan Infrastructure Law for a total of \$5.6B.

**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:** \$58,473,758

**Table 18** *Low or No (LoNo) Emission Vehicle Deployment Projects Receiving Assistance from FTA, FY 2021*

Project	Transit Agency	City and State	FTA Award
5 fuel cell electric buses	SunLine Transit Agency	Thousand Palms, CA	\$9,803,860
5 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 Authority	Dallas, TX	\$7,637,111
5 battery electric buses	Transit Authority of Lexington Fayette Urban County	Lexington, KY	\$6,003,534

<b>Project</b>	<b>Transit Agency</b>	<b>City and State</b>	<b>FTA Award</b>
5 battery electric buses	Los Angeles County Metropolitan Transportation Authority	Los Angeles, CA	\$5,585,000
Deploy charging infrastructure for existing fleet of battery electric buses	Foothill Transit	Greater Los Angeles, CA	\$1,310,000
5 battery electric buses	Alameda-Contra Costa Transit District Commission	Oakland, CA	\$1,551,611
Deploy 3 additional fuel cell electric buses to SARTA's fuel cell electric fleet	Stark Area Regional Transit Authority	Canton, OH	\$4,015,174
5 battery electric buses	Utah Transit Authority	Salt Lake City, UT	\$5,427,100
Deploy 8 additional battery electric buses to King County's electric fleet	King County Metro	Seattle, WA	\$3,336,040
<b>Total</b>			<b>\$58,473,758</b>

## Supporting Programs and Other Initiatives

### 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 US small businesses.

### Objective:

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

### Outputs:

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

The FTA had eight supporting programs and initiatives active in FY 2021, as shown in Table 19.

**Table 19** Supporting Programs and Initiatives Receiving Assistance from FTA, FY 2020

Supporting Programs and Initiatives		
Type of Project	Project Title	FTA Funding
Research	Transit Cooperative Research Program (TCRP)	\$5,000,000
Innovation & Development	Small Business Innovation (SBIR)	\$2,588,696
Evaluation & Implementation	Information Dissemination and Evaluation Program	\$1,439,692
Innovation & Development	Energy Efficient Mobility Systems Program	\$1,000,000
Evaluation & Implementation	Information Dissemination and Outreach Program	\$1,100,000
Evaluation & Implementation	Research Evaluation Implementation Plan	\$480,000
Innovation & Development	Transit Data Research Project Secure Data Commons System	\$100,000
Innovation & Development	Potential Uses of Advanced Data Science Methods in Transit Planning and Operations	\$200,000
<b>Total</b>		<b>\$11,908,388</b>

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

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

### **Project Description:**

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

### **Results:**

The TOPS Commission met in October 2020 to select the FY 2021 Synthesis projects. The members reviewed the problem statements to determine the projects that will be funded. Seven projects were selected. TCRP also continued the dissemination of reports, syntheses of existing practices, legal studies, and ideas deserving exploratory analysis. TCRP supported the public transportation industry and community through conferences, webinars, and project panels, maintaining a high level of public transportation industry and stakeholder engagement. TCRP reports and studies are important resources to public transit agencies that improves operations and service.

**FTA Funding:** \$5,000,000

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

**Recipient:** The Volpe Center

### **Project Description:**

The purpose of the SBIR Program is to help small businesses grow by funding product development research in strategic areas such as safety, operations, maintenance, and other topics important to transit. FTA is one of eight operating administrations within DOT that funds SBIR research. Federal law (15 U.S.C. § 638) mandates that each operating administration set aside a portion of its annual research budget to fund SBIR grants. FTA contributes 3.2% of its yearly research discretionary funding to SBIR grants; FTA's FY 2021 discretionary funding amount for SBIR was \$704,000. The goals of SBIR are to 1) stimulate technological innovation; 2) meet Federal research and development needs; 3) foster and encourage participation in innovation and entrepreneurship by women and socially or economically disadvantaged persons; and 4) increase private-sector commercialization of innovations derived from Federal research and development funding.

### **Results:**

In FY 2021, the program completed a major milestone in the research and development of its mobile augmented reality (AR) application for trip planning and navigation aiding for persons with functional limitations. The Design

Interactive team officially released its AR application titled “Venture 2.0,” releasing a limited version in the Apple Store app. RLS & Associates produced a discussion paper on “Cost and Accounting Considerations in Developing a Non-Emergency Medical Transportation (NEMT) Cost Allocation Model.” The benefit of this paper will potentially help build consensus among key federal partners on general cost and accounting principles, help provide consistency in cost entry among NEMT providers in states, and facilitate consistent application of cost allowability principles. The Phase I projects are underway, completing initial research and testing.

**FTA Funding:** \$2,588,696

**Table 20** *Small Business Innovation Research (SBIR) Projects Receiving Assistance from FTA, FY 2021*

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
<b>Total</b>			<b>\$2,588,696</b>

**Title:** *Information Dissemination and Evaluation Program*

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

**Project Description:**

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

**Results:**

This program concluded in May 2021. CUTR conducted document reviews and a series of interviews with individual Rides to Wellness Demonstration Grants Program recipients. The documentation and interview data were analyzed to assess the projects’ actual vs. expected outcomes against the overall goals of the initiative. The evaluation report titled *Rides to Wellness Demonstration Grants Program Evaluation* (<https://rosap.ntl.bts.gov/view/dot/55685>) was published in March 2021. This evaluation report included an overview of the Rides to Wellness Initiative, profiles of each demonstration project including project outcomes and lessons learned, and findings and recommendations.

**FTA Funding:** \$1,439,692

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

**Recipient:** 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 2021, DOE completed a literature review on general electric vehicle (EV) adoption from a consumer perspective and first-mile/last-mile in public transit and began the development of an initial integrated optimization model that can help transit agencies determine the charging station location, power level, and the number of chargers as well as vehicle battery for an isolated battery electric bus route.

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

## **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:**

In FY 2021, CUTR completed and FTA posted 28 final reports on its Reports and Publications page, accessible at <https://www.transit.dot.gov/research-innovation/fta-reports-and-publications> and the Repository and Open Science Access Portal (ROSA P) in the FTA collection (<https://rosap.ntl.bts.gov/cbrowse?pid=dot%3A42631&parentId=dot%3A42631>). Each report is Section 508-compliant. In addition to the posted reports, several relevant research graphics and templates were created, maintaining FTA's research brand in the transit industry. The efforts under this program provide more efficient use of resources by allowing FTA program managers and recipients to focus more on the technical content of reports rather than the report production process.

**FTA Funding:** \$1,100,000



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

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

### **Project Description:**

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 cascade upward through discrete performance measures to assess the success of FTA's research investments.

### **Results:**

In FY 2021, CUTR created a plan to conduct the independent evaluation for the Human Service Coordination Research (HSCR) Deployment Program. The plan includes documentation review, interviews with each recipient, and data collection to assess the projects' actual vs. expected outcomes against the overall goals of the initiative. CUTR will continue to monitor the performance of each project and to conduct a comprehensive independent evaluation of the HSCR.

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

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

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

### **Project Description:**

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

### **Results:**

FTA concluded its support for the Secure Data Commons in FY 2021. The JPO provided testing and input that resulted in improvements to the SDC functionality, including making it easier for users to access the platform as well as improvements to the training materials, website, and user guide. The platform continued to add new functionality over the course of FY 2021. Projects analyzed on the platform include Waze for Cities data used to analyze roadway safety, Connected Vehicle data for pilot projects in New York City (NY), Tampa (FL), and Wyoming, and Positive Train Control and other rail safety data collected by the Federal Railroad Administration.

**FTA Funding:** \$100,000

## **Title: *Potential Uses of Advanced Data Science Methods in Transit Planning and Operations***

**Recipient:** The Volpe Center

### **Project Description:**

The purpose of this project is to identify challenges such as privacy protection, racial bias and civil rights concerns, and cost, technical, and privacy challenges of working with smartphone data and information sharing, etc., and how to mitigate them. The project will provide an assessment of the strengths and weaknesses of using smartphone data as proxies for traditional ridership data and the readiness of transit agencies to incorporate these data into their operations. The goal is to help transit agencies transform their operations and prepare for the future through the use of innovative analytical methods.

### **Results:**

In FY 2021, the Volpe Center research team met with experts from eight transit agencies and data analytic non-profits and compiled a set of use cases where data science techniques can have a practical, real-world impact. They include:

- Using AI algorithms to predict when a bus component part may fail so that the vehicle can be sent for maintenance before the failure may occur.
- Using image recognition to identify cracks or other defects in transit infrastructure.
- Using machine learning algorithms to better predict bus and rail on-time arrivals, ridership, and vehicle and station crowding.
- Using natural language processing to conduct sentiment analysis on customer feedback provided via social media.

**FTA Funding: \$200,000**



## Acronyms and Abbreviations

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



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