

**United States Department of Transportation
Annual Modal Research Plans FY 2023
Program Outlook FY 2024**

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Executive Summary

The Federal Highway Administration (FHWA) research, development, and technology (RD&T) program is largely governed and shaped by title 23 United States Code (U.S.C.) § 503, which establishes the Highway Research and Development (HRD) program and Technology and Innovation Deployment Program (TIDP). HRD governs the Research and Development (R&D) portion of FHWA's RD&T program. The eligible research areas under HRD include improving highway safety; improving infrastructure integrity; strengthening transportation planning and environmental decisionmaking; and reducing congestion, improving highway operations, and enhancing freight productivity. HRD also provides for conducting exploratory advanced research (EAR).

TIDP governs the technology transfer (T2) portion of FHWA's RD&T program. All aspects of highway transportation relate to TIDP, including planning, financing, operation, structures, materials, pavements, environment, construction, and the time between project planning and project delivery. Under TIDP, responsibilities include conducting T2 activities for the products, technologies, tools, methods, or other findings from highway R&D activities. The eligible research areas under TIDP include accelerating implementation and deployment.

This Annual Modal Research Plan (AMRP) reflects a move toward aligning the FHWA RD&T program with the broad program areas noted in title 23 U.S.C. § 503. The RD&T AMRP programs align with the research areas captured under HRD and TIDP. The programs are as follows: Improving Highway Safety for All Users; Improving Infrastructure Integrity, Sustainability, and Practices; Promoting Equity, Strengthening Transportation Planning, and Enhancing Environmental Decisionmaking; Reducing Congestion, Improving Operations, and Enhancing Freight Productivity; Accelerating the Implementation and Delivery of New Innovations and Technologies; Accelerating the Discovery of Transformational Solutions; and Crosscutting.

This AMRP captures specific processes, events, and actions that are an intentional part of the program implementation, referred to in this document as "activities." Whether ongoing from prior years or new for fiscal year (FY) 2023, the activities are listed and described in the individual AMRP program descriptions in chapters 1 and 2. Additionally, the FHWA AMRP describes "initiatives" throughout the document; these initiatives are examples of specific work occurring under a particular activity. The FHWA RD&T program for FY 2023 includes both follow-on and new initiatives and activities that address emerging needs and the six U.S. Department of Transportation (USDOT) strategic goals.

The primary goal of the FHWA RD&T program is to conduct RD&T that directly supports the strategic goals of FHWA and the USDOT. FHWA's RD&T program identifies and addresses issues of national significance that other research sponsors cannot or will not address, including areas that require higher complexity, higher risk, longer term research, or specific Federal responsibility. The program also supports implementing new requirements under the Bipartisan Infrastructure Law (BIL), enacted as the Infrastructure Investment and Jobs Act (P.L. 117-58). The FHWA RD&T program's activities produce a

clear public benefit, support Federal stewardship roles, meet and address current and emerging needs and challenges, and ensure the coordination of highway RD&T activities.

Through its RD&T programs, FHWA creates efficiencies in the highway and transportation sector and provides information to support policy decisions. The FHWA RD&T program also ensures that critical technical expertise is available in times of crisis or for sensitive matters, including providing technical support during natural disasters, participating in sensitive Federal investigations, and working with other Federal agencies on issues related to national security and defense.

FHWA certifies the content of this plan does not include duplicative research efforts within the FHWA RD&T program for FY 2023. Through coordination with research partners, FHWA conducts research to maximize value and avoid duplication. FHWA focuses on innovations with broad applicability that leverage research investments through programs with successful T2.

The FHWA RD&T program covers the entire innovation lifecycle, per title 23 U.S.C. § 503(a)(1): setting an agenda, conducting R&D, testing and evaluating technologies, and deploying and evaluating market-ready technologies and innovations. This holistic approach to innovation allows FHWA and USDOT to serve as national transportation leaders; thus, FHWA and USDOT can provide a strategic approach to shaping the direction of innovation development that supports national interests. This leadership ensures that by working with partners, FHWA pursues a future that promotes a safe, equitable, and efficient transportation system while supporting economic competitiveness for the Nation, reducing impacts on the environment, and leading the way in developing and promoting transformative solutions. Without the FHWA RD&T program, the Nation would lack strategically aligned research and innovation development and deployment activities—as well as the world-class technical expertise, relevancy, and influence—to ensure that the public has access to the safest, most reliable, and most resilient infrastructure.

FHWA's Office of RD&T is located at the Turner-Fairbank Highway Research Center (TFHRC), a Federally owned and operated national research facility in McLean, VA. TFHRC houses 15 laboratories and support facilities where staff conduct exploratory and applied research. TFHRC staff administer the majority of FHWA's R&D activities in the areas of infrastructure, operations, and safety. Staff in the FHWA offices located at USDOT headquarters primarily conduct or administer research on intelligent transportation systems (ITS), policy, civil rights, planning, and environment. In addition, the FHWA Office of Federal Lands Highway works with Federal Land Management Agencies (FLMA) and Tribal Governments to deliver quality, durable projects and provide technical expertise in emerging technologies.

Additionally, FHWA has a long history of successful coordination and communication with both internal and external partners through USDOT modal administrations. Particularly important is the relationship and coordination between FHWA and the ITS Joint Program Office (JPO). Title 23 U.S.C. §§ 512–519 establishes the ITS program plan. The ITS research program provides for the research, development, and operational testing of ITS to solve

congestion and safety problems, improve operating efficiencies in transit and commercial vehicles, and reduce the environmental impact of growing travel demand. Each USDOT modal administration is responsible for ITS requirements, guidance, and research relevant to that mode.

FHWA leverages long-standing collaborations with State and Federal agencies, academic institutions, and private industry organizations to advance shared goals by coordinating efforts and utilizing the unique capabilities of each. Working within this partnership framework, FHWA strategically identifies opportunities for collaboration, coordination, and independent research that advance the FHWA and USDOT goals. FHWA works closely with the National Academies of Sciences, Engineering, and Medicine's Transportation Research Board (TRB) and with the TRB-sponsored advisory group, the Research and Technology (R&T) Coordinating Committee (RTCC), to obtain an outside perspective on the direction of the FHWA RD&T program and identify future opportunities for coordination and collaboration.

FHWA also supports numerous T2 efforts to accelerate the implementation and delivery of new and proven innovations and technologies that result from highway R&D and benefit all aspects of highway transportation. FHWA has traditionally used a multipronged approach to deployment, including direct technical and financial assistance; training; peer exchanges; collaboration with industry groups to disseminate knowledge and information; and evaluation of deployment methods to determine effectiveness, assess needed improvements, and document outcomes.

Key deployment and T2 stakeholders include State departments of transportation (DOTs) and local agencies, FLMAs, Tribal Governments, and industry groups. These stakeholders are often the intended audiences for the research deployment outputs. FHWA continues to work directly with State and local agencies through the geographically dispersed FHWA Resource Center and with Tribal Governments through FHWA's Office of Federal Lands Highway. The Local and Tribal Technical Assistance centers and other deployment initiatives play a critical role in T2 activities with these stakeholders.

FHWA will use a series of successful deployment avenues in FY 2023, including Every Day Counts (EDC), a State-based model for deployment; Accelerated Innovation Deployment (AID) Demonstration; Accelerating Market Readiness (AMR); and the State Transportation Innovation Council (STIC), a State-based innovation deployment approach.

RD&T Funding Overview

HRD and TIDP provide funding for FHWA's RD&T program. Under the BIL, \$147 million, or about 57 percent of FHWA's RD&T funding, is provided annually to HRD. Of the authorized funds for HRD, \$15 million is legislatively set aside annually for the Strategic Innovation for Revenue Collection (SIRC) program, and \$10 million is set aside annually for the National Motor Vehicle Per-Mile User Fee Pilot. In addition, 3.2 percent of the FHWA extramural R&D budget is reserved for awards to small businesses through the Small Business Innovation Research (SBIR) activity. This competitive, awards-based activity encourages

domestic small businesses to engage in R&D, addressing high-priority research areas within USDOT.

Under the BIL, \$110 million, or about 43 percent of FHWA's RD&T funding, is provided annually to TIDP. Of the authorized funds for TIDP, \$12 million is legislatively set aside annually for the Accelerated Implementation and Deployment of Pavement Technologies (AIDPT) activity, and \$20 million is set aside annually for the Accelerated Implementation and Deployment of Advanced Digital Construction Management Systems (ADCMS).

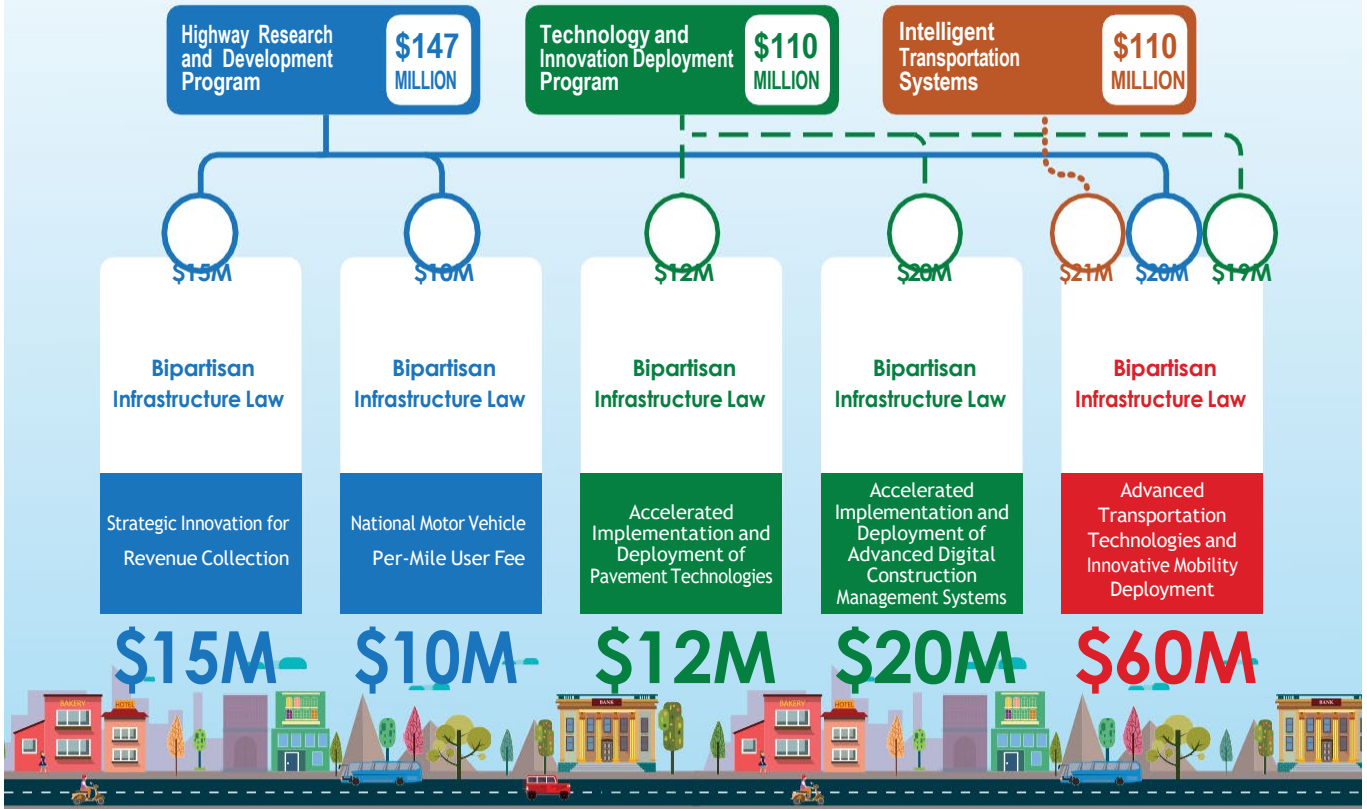
In addition to HRD and TIDP, FHWA RD&T shares some funding, research planning, and research objectives with the USDOT ITS JPO, which has a separate AMRP. Title 23 U.S.C. § 512–519 establishes the ITS program plan with authorized funding of \$110 million annually under the BIL. ITS JPO coordinates and jointly funds activities where there is overlapping responsibility and priorities with the other modal administrations, including FHWA. Each modal administration uses a combination of mode-specific funding and legislatively dedicated ITS funding to accomplish the ITS mission. Additionally, some ITS JPO funds supplement FHWA research activities where additional revenues are needed to meet Department program objectives or ensure synchronization with USDOT multimodal needs.

Title 23 U.S.C. § 503 also establishes Advanced Transportation Technology and Innovation (ATTAIN). ATTAIN provides competitive grants to eligible entities to deploy, install, and operate advanced transportation technologies to improve safety, mobility, efficiency, system performance, intermodal connectivity, and infrastructure return on investment. The BIL provides for a legislative set-aside of \$60 million annually for ATTAIN from HRD, TIDP, and ITS funding.

The following diagram shows how FHWA's RD&T program is funded by FY under BIL.

FHWA RD&T FUNDING

(BIL § 11101(c) and 23 U.S.C. § 503)



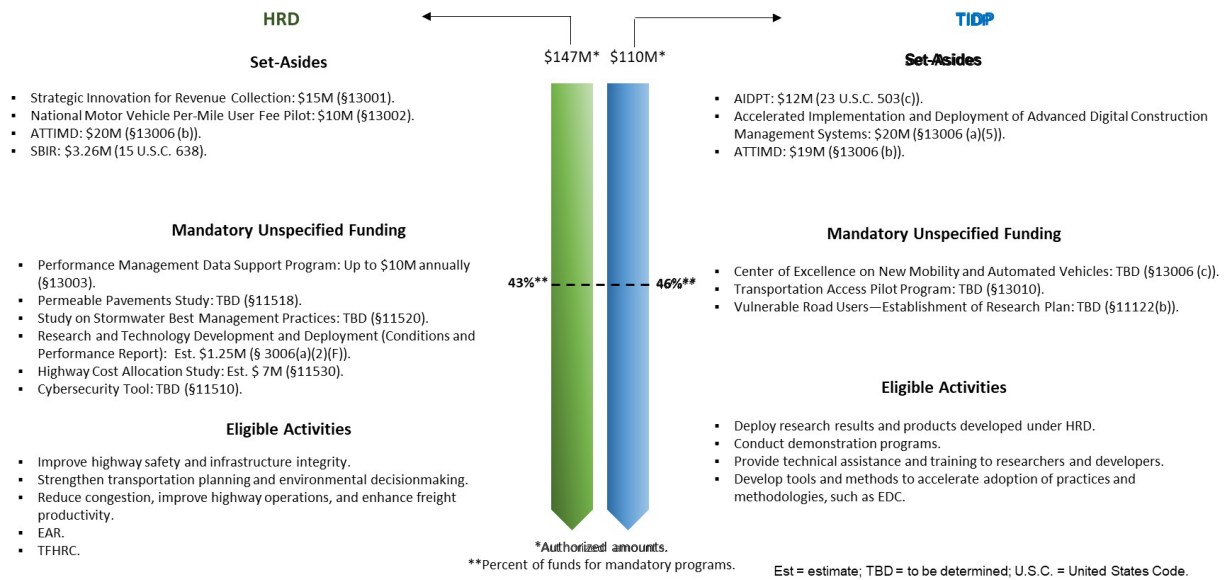
RD & T PROGRAM ACTIVITIES

- Improving highway safety.
- Improving infrastructure integrity.
- Strengthening transportation planning and environmental decisionmaking.
- Reducing congestion, improving highway operations, and enhancing freight productivity.
- Technology transfer to support the planning, financing, operation, structures, materials, pavements, environment, construction, and duration of time between project planning and project delivery.
- Distribute the products, technologies, tools,

Source: FHWA.

Source FHWA.

The following figure highlights the notable RD&T funding under BIL. Additional information about these activities is in chapter 1 and chapter 2.



Source: FHWA.

Addressing the USDOT Strategic Goals

FHWA's RD&T program activities and initiatives improve highway safety, reduce congestion, enhance infrastructure design and construction, invest in transformative solutions, and provide data and analyses to decisionmakers throughout the transportation community. The following sections describe how the FHWA RD&T program supports each USDOT strategic goal.

Safety

FHWA's Improving Highway Safety for All Users program addresses the contributing factors of roadway deaths and injuries related to roadway design, construction, and maintenance. This program develops robust data analysis tools that enable transportation professionals to match crash causes with cost-effective countermeasures. With safety resources aimed at targeted safety problems, State and local agencies can deliver significant safety improvements to the public. FHWA's safety efforts are focused on achieving the following objectives: reducing fatalities and serious injuries for all users on all public roadways; fostering a scientific, data-driven approach to safety decisionmaking; and implementing a performance-driven Highway Safety Improvement Program (HSIP).

As Safety is FHWA's number one strategic goal, nearly all the RD&T programs impact safety. Global outreach is a valuable tool in identifying, accessing, evaluating, and implementing proven international innovations to address safety challenges. FHWA's Highway Data and Information (HDI) activity enables the Agency and the transportation community to conduct systematic safety research and program development. Tools, research activities, and technical assistance under Promoting Equity, Strengthening Transportation Planning, and Enhancing Environmental Decisionmaking support the integration of safety considerations into the project development process.

The Office of Federal Lands Highway and the Office of Tribal Transportation support improved safety for vulnerable users of public roads that typically are not National Highway System (NHS) transportation networks and low average daily traffic (ADT) as well as those on the NHS system. All the activities within the Reducing Congestion, Improving Operations, and Enhancing Freight Productivity program reflect FHWA's support of Safety as the top USDOT strategic goal by smoothing traffic flow, mitigating disruptions, emphasizing critical infrastructure cybersecurity, providing consistent motorist guidance and information about current conditions, and enabling travel choices and safer streets. FHWA's Improving Infrastructure Integrity, Sustainability, and Practices program will reduce the need for, and duration of, highway construction work zones. This program will contribute to improved safety by achieving more durable and resilient highway infrastructure and improved construction practices. FHWA will advance research into wildlife and aquatic organism passage, which promotes safety for the traveling public while producing benefits for the natural environment.

Economic Strength and Global Competitiveness

FHWA supports USDOT's strategic goal of Economic Strength and Global Competitiveness through numerous efforts. The Reducing Congestion, Improving Operations, and Enhancing Freight Productivity program includes operational strategies that enable the efficient

movement of people and goods across the transportation system; activities focus on investing in improvements that will lead to resilient supply chains, system reliability, and connectivity. HDI's travel (demand and condition), fuel, truck speed, and travel behavior data provide valuable and relevant indicators of the performance of the Nation's supply chain. In addition, the travel demand and condition information from the Highway Performance Monitoring System indicates issues or potential issues of highway condition in the overall supply chain. The Modeling and Analysis Tools activity under the Promoting Equity, Strengthening Transportation Planning, and Enhancing Environmental Decisionmaking program can be used to analyze corridor and system operations to increase travel time reliability, manage travel demand, and improve connectivity. Additionally, the Multimodal Connectivity activity will support economic strength, especially in rural communities, by documenting the economic benefits of highways, including scenic byways.

Analytical models developed as part of policy analysis research support the measurement of a key USDOT performance measure to "reduce backlog of \$830 billion in highway repairs by 50 percent by 2040." The Office of Federal Lands Highway will support the Office of Infrastructure in the areas of lifecycle extension and durable products and will advance a bridge lifecycle analysis model to predict asset (structures) deterioration rates to help prioritize projects based on urgency of need and funding available for its FLMA partners.

Infrastructure investment is the foundation of a strong economy. "Innovative finance" generally refers to debt financing, which refers to debt financing, which has the potential to increase the efficiency of current and future cashflows. Although the pay-as-you-go approach to public spending offers little financial risk, it can result in delays that defer the benefits of infrastructure investment. Due to the cost of major projects, debt financing is almost always utilized. Public agencies willing to consider private financing may find opportunities to leverage private sector innovation. The innovative finance activity includes funding for FHWA's Center for Innovative Finance Support, which provides tools, expertise, and financing to help the transportation community explore and implement innovative strategies to deliver costly and complex infrastructure projects.

Equity

FHWA will develop resources that improve equity, access, and mobility for all users, particularly in underserved populations. Through the Promoting Equity, Strengthening Transportation Planning, and Enhancing Environmental Decisionmaking program, FHWA will work with States and metropolitan planning organizations (MPOs) to consider equity early and often through methods such as public participation and data collection and analysis that will improve their ability to adequately respond to community needs through the planning process. Initiatives will implement processes to improve equitable outcomes in transportation network planning and implementation, including in communities near major roadways that are disproportionately affected by air pollution and noise impacts. The Accelerating Project Delivery activity supports efforts to expand and promote virtual public involvement (VPI). This initiative enhances and broadens the reach of public engagement efforts for project development, including considerations and strategies for engaging traditionally underserved individuals and communities.

The Office of Civil Rights uses research funds for many initiatives that evaluate and provide resources, such as handbooks, to practitioners to reduce transportation-related Title VI disparities and adverse community impacts and to increase accessibility in the public right-of-way. Funds will be used to conduct Americans with Disabilities Act (ADA) compliance reviews of States and develop a training course to provide ADA-complaint investigation education. Additional training courses and technical assistance will contribute to Disadvantaged Business Enterprises (DBEs) performing commercially useful function (CUF) monitoring and evaluations and assist in identifying and mitigating potential Title VI disparate impacts.

Most of the activities within the Reducing Congestion, Improving Operations, and Enhancing Freight Productivity program area focus on deploying tools and technologies that help agencies and the public address challenges and improve the quality of transportation system operations and satisfaction for all users. The Office of Federal Lands Highway supports FLMA and Tribal Governments by developing prototype customized asset management models that will allow Tribal transportation departments to identify, analyze, and prioritize adaptation options, substantively informing their transportation decisions.

Many initiatives in the Office of Policy and Governmental Affairs support equity, including a cost allocation study exploring equity from a revenue and taxation perspective and studies and information exchanges with the World Road Association (globally known as PIARC) on issues related to gender inclusion and social equity and social accessibility. In addition, HDI's travel behavior data are the only USDOT-wide resource offering insights into how and why people travel; the data include dimensions of race, ethnicity, income, and education.

Climate and Sustainability

The Office of Planning, Environment, and Realty's models and tools are used to assess and analyze the potential environmental impacts of highway projects. These models and tools also provide important insights and approaches that will contribute to improving air quality, mitigating greenhouse gas (GHG) emissions, reducing noise, and addressing congestion caused by high travel demand on the highway system. FHWA will conduct R&D activities to better inform decisionmaking regarding GHG emissions reduction and performance measurement and ensure transportation decisions are informed by economic, social, and environmental effects and tradeoffs. HDI's fuel data provide the most efficient and reliable GHG emission estimates by State, region, and the Nation; the data offer insight into program and policy effectiveness related to USDOT's Climate and Sustainability goals.

FHWA will also work with other Federal agencies to better predict and estimate the future levels of infrastructure exposure to climate change and extreme weather events, including changes in precipitation patterns, temperature, sea-level rise, and cyclonic storm surges and waves. FHWA's Improving Infrastructure Integrity, Sustainability, and Practices program will make substantial investments to develop and advance tools, technologies, and practices that enable the construction and maintenance of highway infrastructure that is

more resilient and more sustainable. These investments will include lower carbon materials, as well as tools and technologies to support well-founded lifecycle assessments. The Office of Federal Lands Highway will support the development of an asset management prediction model to forecast at-risk culverts for the U.S. Forest Service; vulnerable culverts are the victim of climate change effects such as intense precipitation events and wildfires, causing an increase in debris-flow damage to undersized culverts.

The Reducing Congestion, Improving Operations, and Enhancing Freight Productivity program also contributes through operational strategies that reduce wasted productivity and wasted energy consumption. Planned improvements supported by policy analysis research will focus on incorporating resilience to benefit-cost analysis procedures. Planned research will also focus on options to reduce trips, shift trips to climate-friendly vehicles and modes of travel, and address induced demand.

The Office of Planning, Environment, and Realty will offer climate change and sustainability technical assistance to stakeholders and coordinate activities within USDOT and with other Federal agencies. Several partnerships and exchanges are supporting many climate and sustainability topics, including a Global Benchmarking Program (GBP) study on Green Public Procurement (GPP), which is the process of procuring goods that have a lower environmental footprint across their entire lifecycle.

Transformation

FHWA's RD&T program broadly supports Transformation through research and innovation, including on low-volume roads, which comprise most of the Nation's transportation network. Within the Accelerating the Discovery of Transformational Solutions program, there is a focus on supporting R&D at TFHRC and across all other program areas. FHWA is recognized as a leader in developing and deploying innovations that produce real improvements in the highway environment by enhancing safety, increasing mobility, ensuring infrastructure resiliency and sustainability, and addressing equity issues.

FHWA also helps partners and stakeholders make the best decisions possible. FHWA's Multimodal Connectivity activity promotes the rebalancing of multimodal investments to address inequalities in underserved communities. The Improving Infrastructure Integrity, Sustainability, and Practices program enables and supports infrastructure owners in selecting materials and designing, building, preserving, and managing resilient infrastructure in ways that are more efficient and lower the lifecycle carbon footprint of highway transportation. The Office of Planning, Environment, and Realty will develop planning tools to help States and MPOs that are exploring methodologies in transportation planning understand community needs and provide actionable techniques and tradeoffs between different futures and their relative impacts on different community goals. HDI's effort in data gathering, analysis, and forecasting methods focuses on big data and big data analytics to reveal new transformative ways of doing business at USDOT and FHWA and with State DOTs, MPOs, and other entities and enterprises. Policy analysis initiatives use scenario planning around policy and investment decisions and the analysis of the policy implications of emerging transportation technologies.

FHWA also values collaboration. By optimizing established partnerships with other Federal agencies, the Office of Federal Lands Highway bridges the gap between practitioners and researchers in the areas of assets (structures, culverts, rock walls), vulnerabilities (wildfires and unstable slopes, erosion, and gravel roads), and equity (remote access and equitable access). Additionally, the Office of Planning, Environment, and Realty will develop tools to help environmental practitioners improve collaboration with other agencies and the public. These tools have the potential to accelerate the delivery of transportation projects without sacrificing important collaboration with those affected by the projects. The GBP supports study teams with both implementation expertise and funding to accelerate early implementation activities, starting with the development of an implementation plan. The plan evaluates the most promising technologies and practices identified abroad, shares them with relevant organizations, and develops strategies for domestic adaption and implementation.

Organizational Excellence

FHWA's RD&T program supports data-driven initiatives and policies. The primary objective of FHWA's Policy Analysis research is to provide decisionmakers with empirically based assessments of emerging trends and future transportation needs as well as the potential for Federal policies and strategies to address those needs effectively. Further, the HDI activity supports data-driven policymaking by delivering consistent and credible past, present, and future highway-related data for the entire transportation community, promoting accountability, transparency, economic development, and advanced R&D.

FHWA also supports those with whom it has a working relationship. The Office of Civil Rights provides support to State and local practitioners through oversight and technical assistance related to many topic areas that USDOT and FHWA have identified as key strategies, including ADA, Title VI, and DBE. The Office of Federal Lands Highway, with support from the Center for Accelerating Innovation within the FHWA Office of Transportation Workforce Development and Technology Deployment, sponsors a five-region innovation summit for FLMA partners in the areas of safety, infrastructure, transportation planning, digital tools, and workforce development. Within the Reducing Congestion, Improving Operations, and Enhancing Freight Productivity program, the *Manual on Uniform Traffic Control Devices (MUTCD)* and Managing Disruptions to Operations activities advance policies, processes, and innovations to serve communities effectively.

Highlighted Initiatives That Support USDOT Strategic Goals

The following are examples of initiatives that support USDOT strategic goals that will be addressed as part of the FY 2023 FHWA RD&T program.

Complete Streets: In 2020, the last full year for which data are available, 38,824 people died in motor vehicle traffic crashes nationwide.¹ The National Highway Traffic Safety Administration's (NHTSA) early estimates of motor vehicle

¹[Overview of Motor Vehicle Crashes in 2020 \(dot.gov\)](https://www.dot.gov/overviews/overview-of-motor-vehicle-crashes-in-2020).

traffic fatalities for the first 9 mo of 2021 show 31,720 deaths, an increase of approximately 12 percent from the first 9 mo of 2020 and the largest number of fatalities for that period since 2006.² FHWA is working with State and local transportation agencies and Tribal Governments across the United States to implement a Complete Streets design model that prioritizes safety, comfort, and connectivity to destinations for everyone who uses the street network. A Complete Street is safe, and feels safe, for everyone using the street. In principle, Complete Streets are multimodal and provide safe access for all roadway users. In FY 2023, the Complete Streets initiative will finalize the development of a safety analysis approach and begin testing the approach with case studies developed by other parties. Work will also proceed on developing methods for reducing data collection costs on pedestrians, bicyclists, and other vulnerable road users (VRUs). The primary societal benefit of a Complete Street design model will be in reducing fatalities and serious injuries, which disproportionately affect minority, underserved, and rural communities. Improvements in connected multimodal and low-emission vehicle networks will provide additional economic and social benefits. The multidisciplinary approach toward the development of Complete Streets will define new ways of characterizing the additive effects for air quality, quality of life, and reduction of obesity, among others.

Enabling Novel Pedestrian Analytics: The main objective of this study is to integrate spatial data among traditional, multijurisdictional, and emerging datasets to analyze two measures of pedestrian safety performance: the severity of a pedestrian crash that has occurred and the probability that a pedestrian crash will occur. This research will utilize the newly established data science laboratory within FHWA, the Path to Novel Data Analytics (PANDA) Laboratory, which was highlighted in last year's AMRP. This study will demonstrate to subject matter experts a practical application working with disparate sources of data and data analytics tools. This research will have an equity component that will consider detailed demographics and the development of predictive pedestrian crash models that are focused on socioeconomically disadvantaged communities.

DBE CUF Evaluation Course: Effective CUF reviews are necessary to mitigate the risk of program fraud, which will become a greater risk as BIL funds increase contracting opportunities. CUF is also necessary to prevent State DOT recipients from overcounting a DBE's participation, which would result in fewer opportunities for other DBEs to participate as subcontractors. The Office of Civil Rights has developed monitoring and oversight tools and given national webinars on how to effectively and efficiently perform CUF reviews; however, the information is still not broadly disseminated among recipients. The Office of Civil Rights sees a need to create a National Highway Institute course to reach a broader audience to showcase best practices and helpful tools. This course will be especially important for BIL grantees that do not have experience with DBE program requirements.

²[NHTSA Data Estimates Indicate Traffic Fatalities Continued to Rise at Record Pace in First Nine Months of 2021 | NHTSA.](#)

Research to Reduce GHGs and Improve Resilience to Climate Change: To support climate solutions, FHWA will work to develop and deploy tools for State DOTs and MPOs to analyze GHGs. FHWA also recognizes the need to make transportation infrastructure more resilient to the impact of climate change. For example, FHWA will initiate research to develop a nature-based solutions implementation guide to improve resilience for roads in riverine environments. As the intensity and duration of storms increase and seasonal snowpack melting occurs earlier because of climate change, it is important to protect expensive public infrastructure from the impacts of flooding with an integrated approach to risk reduction. The guidebook will include best practices, tools, and techniques to apply resilient, ecologically sensitive design practically for transportation infrastructure in riverine environments.

Material Innovations for Resilient Structures: Structural engineering research staff at FHWA's TFHRC are developing ways to apply the superior strength and durability of material innovations like ultra-high performance concrete (UHPC) to address the practical challenges of improving highway infrastructure resilience. This work builds upon the success achieved in applying UHPC to achieve the durable connection of prefabricated bridge elements, as well as its use in bridge preservation and rehabilitation, to extend use of this material to new construction.

Informational Report on Accessibility at Innovative New and Quick-Build Pedestrian and Bicycle Designs: The FHWA Office of Human Environment, with funding support from the FHWA Offices of Infrastructure and Safety, will lead a literature review and workshop on how to design a range of new and quick-build-type pedestrian and bicycle facilities (such as floating bus islands, protected intersections, and facilities built with bolt-down materials like some separated bike lanes) to be accessible for pedestrians with disabilities. This effort will also include an experiment on design options for delineated curb extensions for pedestrians with disabilities. This research will help practitioners deploy safer designs while achieving the equitable outcome of ensuring that these designs are accessible and cost effective.

External Cost of Highway Analysis Tool (ECAT): In FY 2023, the Office of Transportation Policy Studies will continue enhancing the ECAT and applying it to the analysis of equity. Currently, ECAT estimates the cost of externalities from highway use, including noise, air pollution, crashes, and congestion. ECAT results can be used by planners to identify inequitable highways and target highway externality mitigation efforts, as well as provide context for discretionary grants considering equity. Updates to ECAT include additional modules covering impacts on water quality, wildlife and ecosystem, agricultural productivity, as well as the effects of road salt use, construction lifecycle emissions, and barrier effects. ECAT is a critical piece of the Highway Cost Allocation Study (HCAS). It will be used to examine the safety, emissions, congestion, and noise-related costs of highway use by various types of users.

Table 1. FY 2023 RD&T Program Funding Details

The FY 2023 RD&T program funding table shows how much funding is dedicated to each RD&T program. It includes the amount of funds for each program that is in the FY 2023 President’s budget request and the total amount of funds spent on basic and applied research, T2, facilities, experimental development, and major equipment and R&D equipment. FHWA does not fund basic research but uses most of the funds on technology deployment and applied research. In FY 2023, FHWA expects to allocate 34.9 percent of R&T funds toward applied research, 58.4 percent for T2, and 6.7 percent for experimental development. No funds are planned for facilities, major equipment, or R&D equipment.

RD&T Program Name	FY 2023 President’s Budget Request (\$000)	Applied (\$000)	Technology Transfer (\$000)	Facilities (\$000)	Experimental Development (\$000)	Major Equipment, R&D Equipment (\$000)
Improving Highway Safety for All Users						
Safety Program Delivery	2,738	0	2,738	0	0	0
Safety Design and Operations	4,698	3,518	1,180	0	0	0
Safety Data and Analysis	4,292	2,740	1,552	0	0	0
Human Factors Analytics	1,719	1,719	0	0	0	0
TOTALS	13,447	7,977	5,470	0	0	0
Improving Infrastructure Integrity, Sustainability, and Practices						
Construction and Project Management	1,678	500	500	0	678	0
Geotechnical and Hydraulics	4,139	1,500	1,139	0	1,500	0
Long-Term Infrastructure Performance	4,698	3,000	698	0	1,000	0
Pavements and Materials	8,166	6,166	0	0	2,000	0
Structures	9,283	4,500	2,500	0	2,283	0
Transportation Performance and Asset Management	1,119	0	719	0	400	0
TOTALS	29,083	15,666	5,556	0	7,861	0

RD&T Program Name	FY 2023 President's Budget Request (\$000)	Applied (\$000)	Technology Transfer (\$000)	Facilities (\$000)	Experimental Development (\$000)	Major Equipment, R&D Equipment (\$000)
Promoting Equity, Strengthening Transportation Planning, and Enhancing Environmental Decisionmaking						
Accelerating Project Delivery	3,285	2,825	460	0	0	0
Performance-Based Planning and Equity	2,300	1,642	329	0	329	0
Modeling and Analysis Tools	2,300	942	920	0	438	0
Resiliency	1,423	657	328	0	438	0
Multimodal Connectivity	1,423	1,073	175	0	175	0
TOTALS	10,731	7,139	2,212	0	1,380	0
Reducing Congestion, Improving Operations, and Enhancing Freight Productivity						
Transportation Systems Management and Operations	4,493	4,493	0	0	0	0
MUTCD	2,000	1,400	400	0	200	0
Automation and Connectivity	6,351	4,599	876	0	876	0
Managing Disruptions to Operations	3,066	1,971	547	0	548	0
Freight Management and Operations	3,723	3,241	82	0	400	0
Truck Size and Weight	1,205	838	0	0	367	0
TOTALS	20,838	16,542	1,905	0	2,391	0
Accelerating the Implementation and Delivery of New Innovations and Technologies						
EDC	7,117	0	7,117	0	0	0
STIC Incentive	6,132	0	6,132	0	0	0
AID	7,117	0	7,117	0	0	0
AMR	2,738	0	2,738	0	0	0
Technology Deployment Support	1,800	0	1,800	0	0	0
Innovative Finance	975	500	475	0	0	0
AIDPT	12,000	1,000	11,000	0	0	0
Accelerated Implementation and Deployment of Advanced Digital Construction Management Systems	20,000	2,000	18,000	0	0	0

RD&T Program Name	FY 2023 President's Budget Request (\$000)	Applied (\$000)	Technology Transfer (\$000)	Facilities (\$000)	Experimental Development (\$000)	Major Equipment, R&D Equipment (\$000)
ATTAIN	39,000	0	39,000	0	0	0
Research Infrastructure, Technology Transfer, and Partnerships	500	143	305	0	52	0
TOTALS	97,379	3,643	93,684	0	52	0
Accelerating the Discovery of Transformational Solutions						
Research Infrastructure, Technology Transfer, and Partnerships	14,830	4,241	9,061	0	1,528	0
EAR	5,190	5,190	0	0	0	0
SBIR	3,262	2,283	325	0	654	0
SIRC	15,000	0	15,000	0	0	0
National Motor Vehicle Per-Mile User Fee	10,000	10,000	0	0	0	0
TOTALS	48,282	21,714	24,386	0	2,182	0
Crosscutting						
Policy Analysis	4,369	3,914	130	0	325	0
Global Outreach	734	257	477	0	0	0
HDI	7,052	5,059	1,858	0	135	0
Civil Rights	900	300	300	0	300	0
Federal Lands Highway	1,687	1,687	0	0	0	0
Emerging/Corporate Needs	22,498	6,434	13,746	0	2,318	0
TOTALS	37,240	17,651	16,511	0	3,078	0
Administrative and Facilities Costs						
<i>Administrative and Facilities Costs</i>	<i>8,685</i>	<i>2,484</i>	<i>5,306</i>	<i>0</i>	<i>895</i>	<i>0</i>
Totals	265,685	92,816	155,030	0	17,839	0

Table 2. FY 2023 RD&T Program Budget Request by DOT Strategic Goal

The following table shows the amount of FY 2023 funds in the President’s budget request for each RD&T program for each of the USDOT’s strategic goals. Most of the requested funds support the Transformation, Safety, and Economic Strength and Global Competitiveness goals. In FY 2023, FHWA expects to allocate the following percentages of R&T funds to support each of the strategic goals: 19.9 percent for Safety, 19.7 percent for Economic Strength and Global Competitiveness, 9.6 percent for Equity, 14.7 percent for Climate and Sustainability, 33.5 percent for Transformation, and 2.6 percent for Organizational Excellence.

RD&T Program Name	FY 2023 President’s Budget Request (\$000)	Safety (\$000)	Economic Strength and Competitiveness (\$000)	Equity (\$000)	Climate and Sustainability (\$000)	Transformation (\$000)	Organizational Excellence (\$000)
Improving Highway Safety for All Users							
Safety Program Delivery	2,738	2,738	0	0	0	0	0
Safety Design and Operations	4,698	4,698	0	0	0	0	0
Safety Data and Analysis	4,292	4,292	0	0	0	0	0
Human Factors Analytics	1,719	1,719	0	0	0	0	0
TOTALS	13,447	13,447	0	0	0	0	0
Improving Infrastructure Integrity, Sustainability, and Practices							
Construction and Project Management	1,678	400	500	0	0	778	0
Geotechnical and Hydraulics	4,139	539	600	0	1,500	1,500	0
Long-Term Infrastructure Performance	4,698	200	2,998	0	500	1,000	0
Pavements and Materials	8,166	466	2,000		3,200	2,500	0
Structures	9,283	2,000	2,000		2,000	3,283	0
Transportation Performance and Asset Management	1,119	100	500	0	119	400	0
TOTALS	29,083	3,705	8,598	0	7,319	9,461	0

RD&T Program Name	FY 2023 President's Budget Request (\$000)	Safety (\$000)	Economic Strength and Competitiveness (\$000)	Equity (\$000)	Climate and Sustainability (\$000)	Transformation (\$000)	Organizational Excellence (\$000)
Promoting Equity, Strengthening Transportation Planning, and Enhancing Environmental Decisionmaking							
Accelerating Project Delivery	3,285	548	0	1,094	1,095	548	0
Performance-Based Planning and Equity	2,300	329	438	1,094	110	329	0
Modeling and Analysis Tools	2,300	0	329	657	657	657	0
Resiliency	1,423	0	0	0	1,423	0	0
Multimodal Connectivity	1,423	438	438	437	55	55	0
TOTALS	10,731	1,315	1,205	3,282	3,340	1,589	0
Reducing Congestion, Improving Operations, and Enhancing Freight Productivity							
Transportation Systems Management and Operations	4,493	899	1,572	224	899	899	0
MUTCD	2,000	1,000	600	200	0	100	100
Automation and Connectivity	6,351	1,334	889	889	1,334	1,905	0
Managing Disruptions to Operations	3,066	981	429	276	767	429	184
Freight Management and Operations	3,723	621	1,836	475	55	736	0
Truck Size and Weight	1,205	38	885	0	282	0	0
TOTALS	20,838	4,873	6,211	2,064	3,337	4,069	284
Accelerating the Implementation and Delivery of New Innovations and Technologies							
EDC	7,117	1,780	1,780	1,425	1,780	352	0
STIC Incentive	6,132	1,530	1,530	1,225	1,530	0	317
AID	7,117	1,780	1,780	1,425	1,780	352	0
AMR	2,738	685	685	550	685	133	0
Technology Deployment Support	1,800	0	0	0	0	1,800	0
Innovative Finance	975	0	975	0	0	0	0

RD&T Program Name	FY 2023 President's Budget Request (\$000)	Safety (\$000)	Economic Strength and Competitiveness (\$000)	Equity (\$000)	Climate and Sustainability (\$000)	Transformation (\$000)	Organizational Excellence (\$000)
AIDPT	12,000	300	8,000	300	2,200	1,200	0
Accelerated Implementation and Deployment of Advanced Digital Construction Management Systems	20,000	500	3,000	250	250	16,000	0
ATTAIN	39,000	7,800	7,800	7,800	7,800	7,800	0
Research Infrastructure, Technology Transfer, and Partnerships	500	125	75	50	50	150	50
TOTALS	97,379	14,500	25,625	13,025	16,075	27,787	367
Accelerating the Discovery of Transformational Solutions							
Research Infrastructure, Technology Transfer, and Partnerships	14,830	3,707	2,225	1,483	1,483	4,449	1,483
EAR	5,190	500	0	500	1,000	3,190	0
SBIR	3,262	544	544	544	544	543	543
SIRC	15,000	0	0	0	0	15,000	0
National Motor Vehicle Per-Mile User Fee	10,000	0	0	0	0	10,000	0
TOTALS	48,282	4,751	2,769	2,527	3,027	33,182	2,026
Crosscutting							
Policy Analysis	4,369	0	1,335	0	250	2,488	296
Global Outreach	734	233	0	35	233	233	0
HDI	7,052	1,871	1,762	554	1,737	705	423
Civil Rights	900	0	0	750	0	0	150
Federal Lands Highway	1,687	300	250	200	687	50	200

RD&T Program Name	FY 2023 President's Budget Request (\$000)	Safety (\$000)	Economic Strength and Competitiveness (\$000)	Equity (\$000)	Climate and Sustainability (\$000)	Transformation (\$000)	Organizational Excellence (\$000)
Emerging/Corporate Needs	22,498	5,624	3,375	2,250	2,250	6,749	2,250
TOTALS	37,240	8,028	6,722	3,789	5,157	10,225	3,319
Administrative and Facilities Costs							
<i>Administrative and Facilities Costs</i>	<i>8,685</i>	<i>2,172</i>	<i>1,304</i>	<i>868</i>	<i>868</i>	<i>2,605</i>	<i>868</i>
Totals	265,685	52,791	52,434	25,555	39,123	88,918	6,864

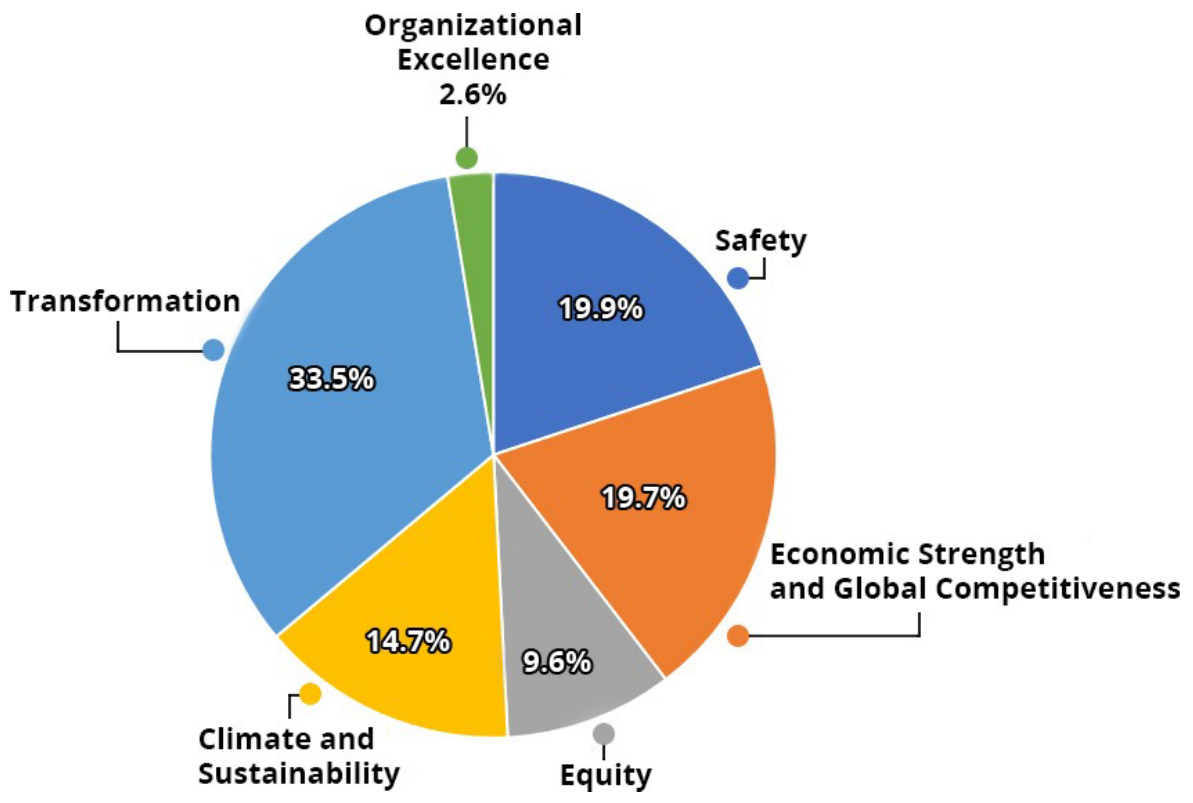
The AMRP reflects funding as found in the FY 2023 President's budget request per 49 U.S.C. Chapter 65 Sec. 6501 Research Planning. The FY 2023 enacted numbers will be posted as part of the FY2024 President's budget request.

Table 3. Summary of FY 2023 RD&T Program Budget Request by DOT Strategic Goal and AMRP Program

The following table shows a summary of table 2 from top to bottom and illustrates the percent of the FY 2023 RD&T Program Budget Request by each AMRP program from left to right. In FY 2023, FHWA expects to allocate 60 percent of the budget request to the discovery and implementation of new innovations and transformational solutions.

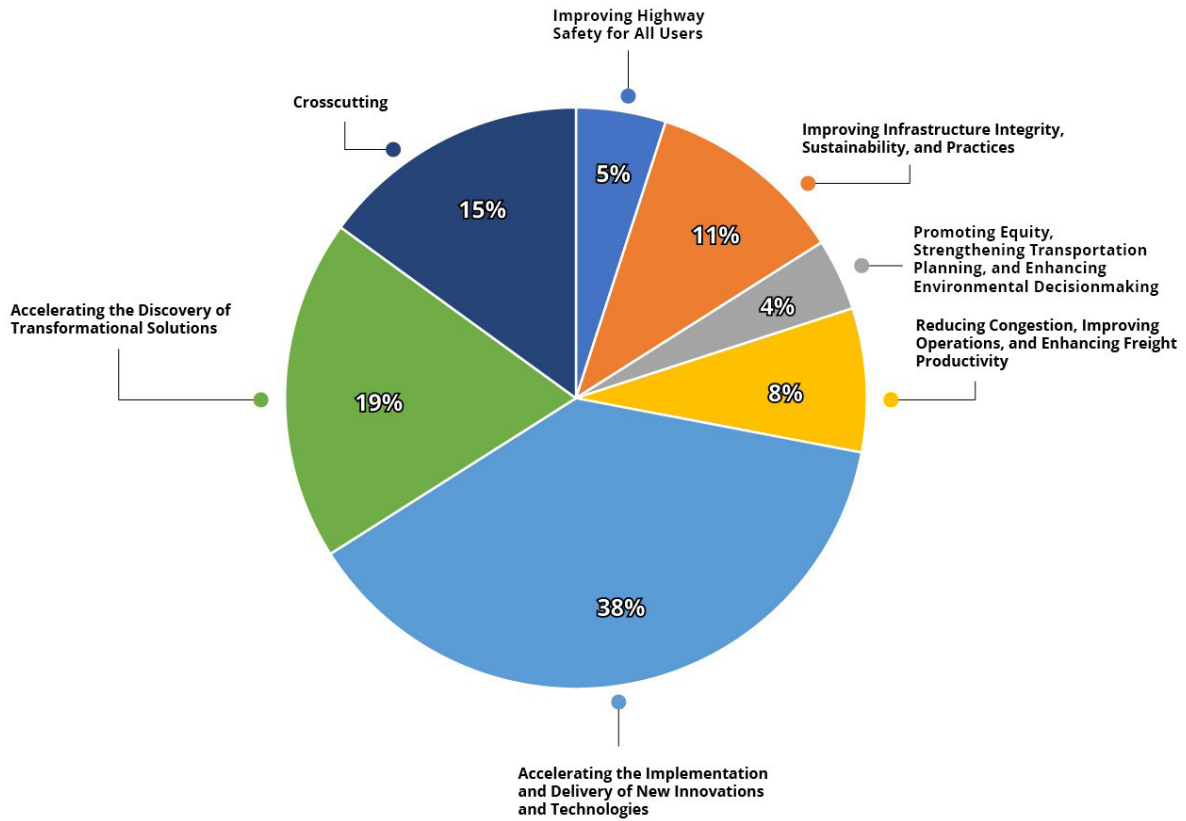
RD&T Programs	Safety (\$000)	Economic Strength and Global Competitiveness (\$000)	Equity (\$000)	Climate and Sustainability (\$000)	Transformation (\$000)	Organizational Excellence (\$000)	Total
Improving Highway Safety for All Users	13,447	0	0	0	0	0	13,447 (5%)
Improving Infrastructure Integrity, Sustainability, and Practices	3,705	8,598	0	7,319	9,461	0	29,083 (11%)
Promoting Equity, Strengthening Transportation Planning, and Enhancing Environmental Decisionmaking	1,315	1,205	3,282	3,340	1,589	0	10,731 (4%)
Reducing Congestion, Improving Operations, and Enhancing Freight Productivity	4,873	6,211	2,064	3,337	4,069	284	20,838 (8%)
Accelerating the Implementation and Delivery of New Innovations and Technologies	14,500	25,625	13,025	16,075	27,787	367	97,379 (38%)
Accelerating the Discovery of Transformational Solutions	4,751	2,769	2,527	3,027	33,182	2,026	48,282 (19%)
Crosscutting	8,028	6,722	3,789	5,157	10,225	3,319	37,240 (15%)
Total	50,619 (19.9%)	51,130 (19.7%)	24,687 (9.6%)	38,255 (14.7%)	86,313 (33.5%)	5,996 (3%)	257,000

The following two pie charts show this same information in a different format.



Source: FHWA.

Summary of FY 2023 RD&T Program Budget Request by DOT Strategic Goal



Source: FHWA.

Summary of FY 2023 RD&T Program Budget Request by AMRP Program

Chapter 1—FY 2023 RD&T Programs

Improving Highway Safety for All Users (\$13,447,000)

Program Description:

The Improving Highway Safety for All Users program primarily supports USDOT’s strategic goal of Safety, and also the Equity goal, by conducting research, developing training, and assisting USDOT’s partners and stakeholders in applying the Safe System Approach with the aim of achieving zero deaths. The program provides support for the HSIP that aims to achieve a significant reduction in fatalities and serious injuries on all public roads.

The Improving Highway Safety for All Users program also advances the safety engineering work that overlaps with traffic engineering, geometric roadway design, transportation planning, and system management and operations. The program aims to help stakeholders reduce fatalities and serious injuries for all users on all public roadways. Further research into data analysis aims to improve State and local safety data systems that commonly record crash, roadway inventory, and traffic volume data. The program also researches needs among all roadway users to better understand human behavior and the relationship among all users, infrastructure, and vehicles.

Major Program Objectives:

The Improving Highway Safety for All Users program will apply the principles of the Safe System Approach that considers human error and focuses on countermeasure development that improves the protection of vehicle occupants, pedestrians, bicyclists, and other VRUs. The program will also invest in topics such as data-driven safety plans to reduce rural roadway departures and analysis of human behavior in response to automated vehicle technologies.

Pedestrian and motorcyclist safety continue to be focuses of the broader safety program because annual pedestrian and motorcyclist fatalities are at their highest levels in decades. A pedestrian safety initiative launched in 2020 will establish enhanced equity methods for pedestrian data collection and more accurate determination of how and where pedestrian risk is greatest. Continued partnership with TRB’s National Cooperative Highway Research Program (NCHRP) is testing new designs for roadside safety hardware and innovative barrier materials. In FY 2023, FHWA’s Human Factors Team will expand the capability of the Virtual/Augmented Reality Laboratory to support and evaluate various pedestrian and bicyclist testing. Further human factors initiatives will assess automated vehicle operations, safety applications, and use cases to understand human behavior effects. New analytics are under development to provide greater focus on alleviating the impact on social and demographic communities that suffer disproportionately from preventable death and fatal injury from crashes.

Anticipated Program Activities:

The Improving Highway Safety for All Users program aims to conduct a range of R&D activities that support the evolving needs of all roadway users and advance the Agency’s

commitment to the Safe System Approach. New work activities will expand detection technologies for pedestrians, wheelchair users, and other VRUs. Further activities on intersection and roadway departure research will yield more precise factors to evaluate the effectiveness of safety countermeasures. Continued work with FHWA partners in the HSIP will increase the deployment of lifesaving safety countermeasures for all roadway users.

The Improving Highway Safety for All Users program also supports the VRU Research Plan that will prioritize research on roadway designs, the development of safety countermeasures to minimize fatalities and serious injuries to VRUs, and the promotion of bicycling and walking. In FY 2022, FHWA used \$150,000 to develop the plan. However, additional funding will be needed in future years to carry out the research.

Key FY 2023 FHWA Improving Highway Safety for All Users R&T Program Activities.

Activity
Safety Program Delivery (\$2.738 M)
Safety Design and Operations (\$4.698 M)
Safety Data and Analysis (\$4.292 M)
Human Factors Analytics (\$1.719 M)

Potential Program Outputs, Outcomes, and Impacts:

There is a range of anticipated program outcomes that express the breadth of this program.

Safety Program Delivery

In 2023, this activity will focus on providing guidance, policies, tools, and technical assistance to improve safety. Through the HSIP and other efforts, FHWA will continue to encourage a data-driven, performance-based approach to saving lives. Efforts in FY 2023 will build upon the FY 2022 activities and ensure alignment with the USDOT and FHWA strategic plans. The main goal of Safety Program Delivery activities is to reduce the number of motor vehicle fatalities and serious injuries on the Nation’s roads.

Safety Design and Operations

Under this activity, staff are leading and collaborating on a number of initiatives in the areas of traffic engineering, geometric roadway design, roadside safety, transportation planning, system management and operations, VRU safety, speed management, data-driven safety analysis, and connected and automated vehicles (CAVs). In FY 2023, FHWA will continue to research how to improve infrastructure to reduce fatalities and serious injuries, build its knowledge base of safety improvements, and fill information gaps. Efforts in FY 2023 will build upon the FY 2022 activities and ensure alignment with the USDOT and FHWA strategic plans. Research results on the safety effectiveness of pedestrian signs embedded with light-emitting diodes will be available in FY 2023. Work with the National Park Service and the FHWA Office of Federal Lands Highway will produce testing reports and design refinements for aesthetic barriers. FHWA’s collaboration with the Texas DOT on evaluating augmented traveler information during construction on I-35 will reveal results on how work-zone operations can be further enhanced with connected vehicle technology.

Safety Data and Analysis

Data-driven technologies and decisionmaking are key themes for all FHWA programs, especially for Safety. The Safety Data and Analysis activity reflects the emphasis placed on supporting highway infrastructure investment decisionmaking. The main goal of the activity is to discover new ways to use data and analysis tools to save lives and improve the ability of road owners and operators to make science-based safety decisions. Efforts in FY 2023 will build upon the FY 2022 activities and ensure alignment with the USDOT and FHWA strategic plans. In FY 2023, continued work on developing crash modification factors will yield reports for the safety performance of mini-roundabouts, wrong-way driving treatments, and improvements at intersections that focus on bicyclist needs. Additional work will evaluate the safety performance of innovative intersection designs for pedestrians and bicyclists.

Human Factors Analytics

This activity aims to accomplish the following:

- Improve the effectiveness of safety countermeasures as well as tools that promote operational efficiency.
- Understand how CAVs can be safely integrated into the Nation's roadway systems by evaluating the human behaviors related to the deployment of cooperative automation.
- Improve roadway designs that meet the needs of drivers, pedestrians, and vulnerable users.
- Understand how people respond to the roadway environment, including signs and markings, emerging vehicle and roadway technology, innovative operational changes, safer streets with improved walkability, and other new roadside innovations.
- Identify how human factors may guide safety programs and enable innovative approaches to improving safety.

In FY 2023, there will be research results that consider the safety issues of automated vehicle technology related to infrastructure. Additionally, guidelines on variable message signage during nonrecurring events will provide more human-response research into how this technology may enable proactive roadway management to reduce secondary crashes. Continued work will yield research results on operational guides for cooperative driving automation (CDA) that promote safe operation in the presence of pedestrians and VRUs.

Potential Economic or Societal Impacts:

The Safe System Approach is based on six principles: deaths and serious injuries are unacceptable, humans make mistakes, humans are vulnerable, responsibility is shared, safety is proactive, and redundancy is crucial. The Safe System Approach has resulted in dramatic improvements in highway safety around the world. In this program, FHWA is introducing the Safe System Approach as a guide toward defining the priorities for the program as a whole. The Safe System Approach broadens FHWA's view of the safety of the transportation system. It encompasses working closely with roadway professionals beyond

the safety discipline and with agencies and organizations responsible for other aspects of the transportation system to achieve safe roads, safe speeds, safe people, safe vehicles, and better post-crash care. FHWA's Safe System Approach will include a focus on safety for road users outside of vehicles—the pedestrians, bicyclists, motorcyclists, and others who make up a growing portion of roadway fatalities.

Potential Progress Made Toward Achieving Strategic Goals:

The Improving Highway Safety for All Users program is making steady progress in realizing the primary USDOT goal of Safety while recognizing that there is an important Equity goal that also needs to be addressed. The program continues to develop and promote tools that lead to the reduction of harm from roadway departure, infrastructure, and pedestrian crashes. Efforts through prior EDC activities continue in practice today, with many State partners adopting data-driven safety assessments as part of their routine practices. This effort has been further advanced through FHWA's collaboration with the American Association of State Highway and Transportation Officials (AASHTO) to deliver tools, training, and technical assistance for the Interactive Highway Safety Design Model (IHSDM) and prepare the States to manage the tool.

Collaboration Partners:

The Improving Highway Safety for All Users program collaborates internally and externally to develop research activities and exchange information among peer organizations. FHWA manages pooled fund studies (PFS) including Traffic Control Devices, the Evaluation of Low-Cost Safety Improvements, and the Naturalistic Driving Study to collaborate with dozens of State DOT partners, local agencies, and associations to address research needs to further streamline implementation. FHWA staff engaged in this program are active participants in national and international organizations and committees such as PIARC, TRB, the Institute of Transportation Engineers (ITE), AASHTO, the National Safety Council (NSC), Operation Lifesaver, and the Governors Highway Safety Association.

Improving Infrastructure Integrity, Sustainability, and Practices (\$29,083,000)

Program Description:

FHWA's Improving Infrastructure Integrity, Sustainability, and Practices program consists of a coordinated set of RD&T activities focused on leading, supporting, and enabling improvements in highway infrastructure integrity, sustainability, and practices. The program provides the data, information, and systems required to link Federal transportation investments to improvements in system performance. It delivers tools, technologies, information, and guidelines that highway owners can apply to effectively maintain and improve infrastructure integrity and meet user needs. The leadership and work products provided through FHWA's Improving Infrastructure Integrity, Sustainability, and Practices program are aligned with the USDOT's strategic goal of Transformation and will contribute to the achievement of the Safety, Economic Strength and Global Competitiveness, and Climate and Sustainability strategic goals.

Major Program Objectives:

The overarching objective of FHWA's Improving Infrastructure Integrity, Sustainability, and Practices program is to support and enable advances in infrastructure materials, engineering, construction, and management practices to bring about improved infrastructure integrity, safety, and sustainability. The program works to achieve the following:

- Transform infrastructure construction, contracting, and stewardship practices to achieve long-lasting, resilient infrastructure and safer construction work zones efficiently.
- Support and enable improved infrastructure resiliency.
- Develop more durable and sustainable materials.
- Provide guidelines and tools to support comprehensive lifecycle assessment of infrastructure sustainability.

The Improving Infrastructure Integrity, Sustainability, and Practices program also includes developing and delivering transformational technologies to substantially improve the durability (and ultimately the sustainability and safety) of bridges and pavements and enhance material availability. The program also supports the implementation of the updated National Bridge Inspection Standards (NBIS) and the National Tunnel Inspection Standards (NTIS), thereby enhancing the safety of this critical highway infrastructure. Additionally, FHWA research is delivering the data and information infrastructure owners need to manage pavement and bridge conditions effectively and providing tools, technologies, and guidance to advance the effective management of highway infrastructure and system performance.

Anticipated Program Activities:

The Improving Infrastructure Integrity, Sustainability, and Practice program supports the Permeable Pavements Study. The study will examine the effects of permeable pavements on flood control in different contexts, including in urban areas, and over the lifetime of the

permeable pavement. This work was fully funded at \$150,000 in FY 2022 and will continue into FY 2023.

Planned FY 2023 Improving Infrastructure Integrity, Sustainability, and Practice program activities are listed in the following table. These activities encompass projects spanning the technology spectrum from applied research through deployment of established technologies and address infrastructure lifecycle phases from design onward. Allocation of funding among these activities has been adjusted from prior years based on consideration of current needs and priorities.

Key FY 2023 FHWA Improving Infrastructure Integrity, Sustainability, and Practices R&T Program Activities.

Activity
Construction and Project Management (\$1.678 M)
Geotechnical and Hydraulics (\$4.139 M)
Long-Term Infrastructure Performance (\$4.698 M)
Pavements and Materials (\$8.166 M)
Structures (\$9.283 M)
Transportation Performance and Asset Management (\$1.119 M)

Potential Program Outputs, Outcomes, and Impacts:

Construction and Project Management

Outputs include information concerning work-zone risks; tools, technologies, training, educational materials, and updated construction planning and contract administration guidance and training; and best practices dissemination. Expected outcomes include cultural change with respect to work-zone safety management, more efficient construction, and more effective contract administration. These advances will help minimize work-zone fatalities and serious injuries, reduce construction-related traffic disruption, and bring about more cost-effective highway infrastructure.

Geotechnical and Hydraulics

Outputs include advancements in research, tools and technologies, guidance, and training in innovative geotechnical design and construction methods; advanced site and laboratory characterization; geotechnics of scour; geotechnical asset and performance management; geotechnical aspects of pavements; hydrology (including floodplains); highway drainage; bridges and culvert hydraulics; hydraulics of scour; and coastal engineering. Expected outcomes include the transfer and application of new approaches and technologies, datasets, and state-of-the-art geotechnical and hydraulic engineering practices to efficiently design, construct, and manage geotechnical and hydraulic assets for improved long-term performance. This multifaceted program activity yields an effective, crosscutting approach to address geotechnical and hydraulic challenges, resulting in more resilient and cost-effective highway infrastructure.

Long-Term Infrastructure Performance (LTIP)

Outputs will include expansion of readily accessible datasets documenting infrastructure performance and findings derived through analysis of infrastructure performance data. Outcomes will include more widespread application of FHWA datasets, accelerating the rate at which findings are generated, and enhanced understanding of infrastructure performance. Application of the knowledge gained will result in more effective management of highway infrastructure conditions.

Pavements and Materials

Outputs will include data and research findings concerning materials innovations (including materials having lower embedded carbon) and pavement resiliency, proposed specifications and guidelines for material selection and mixture design, guidelines for the use of local materials, improved methods to assess pavement condition, and guidelines for more effective management of pavement condition. Outcomes will include more durable, resilient, and sustainable pavements and more effective management of pavement condition. Ultimately, this work will contribute to reducing both the lifecycle cost and the carbon footprint of pavements and improvements in system reliability, sustainability, and safety.

Structures

Outputs will include revised guidelines, training, and systems in support of the updated NBIS and NTIS, as well as proposed guidelines and specifications for innovations in bridge design, preservation, and construction. Outcomes arising from this work will include more effective bridge and tunnel safety inspection practices and more durable and resilient bridges and structures, thereby contributing to lower lifecycle cost and carbon footprint of bridges and tunnels, and improvements in system reliability and safety.

Transportation Performance and Asset Management

Research will produce next-generation performance measures as well as benefit-cost and tradeoff analysis tools, training, and guidelines. These outputs will contribute to achieving more comprehensive lifecycle planning and support risk analysis that considers system resilience to bring about more effective management of highway system performance.

Potential Economic or Societal Impacts:

The potential economic and societal impact of FHWA's infrastructure research investments is substantial. The improvements in infrastructure condition, resiliency, sustainability, construction, and management enabled by this work will make highways safer, improve system reliability, and reduce GHG emissions arising from highway transportation. As a result, the social, economic, and environmental costs of highway transportation will be reduced.

Potential Progress Made Toward Achieving Strategic Goals:

As is evident from the outcomes and impacts described in the preceding sections, FHWA's Improving Infrastructure Integrity, Sustainability, and Practice program will make substantive contributions to achieving the USDOT Transformation strategic goal. The Improving Infrastructure Integrity, Sustainability, and Practice program will also

contribute to achieving the Safety, Economic Strength and Global Competitiveness, and Climate and Sustainability strategic goals by supporting and enabling accelerated project delivery and improved infrastructure integrity. In addition, the program will contribute through work with materials that reduce GHG emissions arising from highway infrastructure construction, preservation, and maintenance.

Collaboration Partners:

FHWA infrastructure leaders and program staff regularly engage with key stakeholders in both formal and informal settings to gather input concerning challenges and opportunities that might be addressed through the program as well as information on work undertaken by other organizations both nationally and internationally. Stakeholders include representatives of individual State DOTs; pertinent committees of AASHTO and TRB; industry organizations (e.g., the American Society of Civil Engineers; the National Asphalt Pavement Association (NAPA); the American Concrete Pavement Association (ACPA); the National Stone, Sand & Gravel Association; the Precast/Prestressed Concrete Institute; the National Steel Bridge Alliance; the Deep Foundations Institute; the International Association of Foundation Drilling; the Geosynthetic Materials Association; the Associated General Contractors of America (AGC); and the American Road & Transportation Builders Association (ARTBA)); standard-setting organizations such as the American Concrete Institute (ACI) and ASTM International; and university faculty engaged in related work. Peer exchanges and technical feedback group meetings are held to exchange best practices and ascertain stakeholder needs. Participation in PFS projects provides for collaboration with State and industry stakeholders to address shared issues.

The individual State DOT owners of the pavements and bridges under study through LTIP research actively support data collection efforts. Their active engagement makes LTIP research possible. Due to the importance of their engagement, FHWA contracts with TRB for a Federal Advisory Committee Act (FACA)-compliant LTIP Advisory Committee that provides consensus stakeholder advice on the conduct of the program via letter reports to the FHWA Administrator. In addition, FHWA LTIP activity staff regularly engage with stakeholders in both formal and informal settings to gather input concerning challenges and opportunities that might be addressed through the program, as well as information on related work undertaken by other organizations both nationally and internationally. A State coordinators group has been established for each program as a forum to strengthen the partnership between FHWA and the State DOTs.

FHWA engages with the other DOT modal administrations through both the USDOT State of Good Repair working group and activity-specific collaboration. Additionally, FHWA collaborates with other Federal agencies such as the National Institute of Standards and Technology (NIST), FLMAs, U.S. Geological Survey, and National Oceanic and Atmospheric Administration on topics of mutual interest and concern.

Formal interactions with AASHTO, TRB, and industry organizations generally occur at regular intervals (at least annually and as often as quarterly) but are not formally tracked or measured. Ad hoc interactions in the form of technical assistance requests are logged on an internal SharePoint site.

Promoting Equity, Strengthening Transportation Planning, and Enhancing Environmental Decisionmaking (\$10,731,000)

Program Description:

The Promoting Equity, Strengthening Transportation Planning, and Enhancing Environmental Decisionmaking research program will carry out RD&T to improve and minimize the cost of transportation planning and environmental decisionmaking processes and minimize the potential impact of surface transportation on the environment. This program supports many of USDOT's strategic goals.

Accelerating Project Delivery

The Accelerating Project Delivery activity supports innovative research programs to address environmental stewardship and equity in project delivery. This activity helps FHWA develop well-informed and environmentally sound transportation projects and initiatives through National Environmental Policy Act (NEPA) implementation initiatives, improved coordination and communication between agencies and the public, and capacity-building initiatives for environmental practitioners. The primary strategic goals of the Accelerating Project Delivery activity are Safety, Climate and Sustainability, and Equity; a secondary goal is Transformation.

Accelerating Project Delivery research also supports the development of rulemaking, guidance, and best practices for real property acquisition processes, which includes relocation planning. Project scheduling uses relocation planning information to develop a timeframe to complete the real property acquisition process. Relocation planning helps develop solutions to problems and challenges brought about by the impacts of surface transportation projects on the pre- and post-project environment for the community and individuals.

Performance-Based Planning and Equity

The Performance-Based Planning and Equity research activity supports title 23 U.S.C. §§ 134–135 and implements title 23 Code of Federal Regulations (CFR) Part 450, in which the USDOT is required to work with States and MPOs and encourage continuous improvement and evolution of metropolitan and statewide transportation planning processes using a performance-based planning and programming (PBPP) approach. The USDOT assists States and MPOs in identifying and meeting performance measures and associated targets related to national highway and transit performance goals. USDOT also provides risk-based oversight and stewardship on performance measures and targets. Additionally, Executive Order 13985 (“Advancing Racial Equity and Support for Underserved Communities Through the Federal Government”) requires Federal agencies to advance equity across the Federal Government to create opportunities for improving communities that have been historically underserved and provide all people an opportunity to reach their full potential.

The Performance-Based Planning and Equity activity will work with States and MPOs to provide a strategic and data-driven approach to transportation decisionmaking that allows agencies to implement PBPP while efficiently allocating resources, maximizing the return on investments, and achieving desired performance goals. This work will also increase accountability and transparency to the public. PBPP connects performance measures and performance target levels that lead to effective data-driven transportation solutions. These measures and targets are connected through long-range transportation plans and transportation improvement programs developed at the statewide and metropolitan levels. Performance-Based Planning and Equity research will advance multimodal networks focused on developing resources that improve access and mobility for all users, particularly in underserved populations, and implement processes to improve equitable outcomes in multimodal network planning and implementation. This activity includes ensuring equity in the implementation of accessible multimodal mobility options as well as integrating efficient and affordable mobility innovation in transportation plans and projects.

Modeling and Analysis Tools

The Modeling and Analysis Tools research activity focuses on developing new analytical tools. It also refines existing tools to help decisionmakers understand how highway projects improve the performance of the Nation's highway system while minimizing the potential impacts of surface transportation on the environment. These tools will enhance transportation planning and decisionmaking in a cost-efficient and environmentally responsible manner. This research supports the opportunity for communities to participate fully in highway project decisionmaking by providing more comprehensive and accurate information about the environmental impacts of highway projects and alternatives being considered for each project, as well as identifying innovative and effective mitigation strategies.

The goal of the research activity is to provide stakeholders at State DOTs, MPOs, and the public with the best tools, data, and regulatory framework to protect human health and the environment. The research activity also explores and adapts modeling methodologies for transportation planning to allow State DOTs and MPOs to better understand their transportation systems. In addition, the activity provides decisionmakers with actionable techniques and tools to better understand how a complex transportation system reacts to investments and policy changes and efficiently makes tradeoffs between performance metrics.

This research activity supports four of USDOT's strategic goals: Climate and Sustainability, Equity, Safety, and Economic Strength and Global Competitiveness. Models and tools are developed to assess and analyze potential environmental impacts of highway projects and to provide important insights and approaches that will contribute to improving air quality, mitigating GHG emissions, reducing noise, and addressing congestion caused by the high demand for travel on the highway system. These tools will also help evaluate the impacts and identify equitable transportation project decisions, especially in communities near major roadways that are disproportionately affected by air pollution and noise impacts. In addition, the tools can evaluate the potential health effects of harmful emissions, especially on vulnerable and overburdened communities, and provide data to help identify options to

reduce health and safety risks for the public, including vulnerable populations. These tools can also be used to analyze corridor and system operations to increase travel time reliability, manage travel demand, and improve connectivity. This analysis can help promote the adoption of noteworthy multimodal transportation system management and operations practices.

Resiliency

The Resiliency research activity focuses on the development and deployment of tools, techniques, strategies, and methodologies for assessing the resiliency, efficiency, and sustainability of transportation plans, projects, and programs. Addressing the risk of damage and service disruption and increases in lifecycle cost of infrastructure caused by climate change, extreme weather events, and natural hazards is essential in ensuring the continued integrity, safety, and function of the highway system. To better address these risks and vulnerabilities, FHWA will conduct research and develop activities to integrate resiliency and sustainability into transportation planning, project development, and design. FHWA will also work with other Federal agencies to better predict and estimate the future levels of infrastructure exposure to climate change and extreme weather events, including changes in precipitation patterns, temperature, sea-level rise, and cyclonic storm surges and waves. FHWA will conduct R&D activities to better inform decisionmaking regarding GHG emissions reduction and performance measurement and ensure transportation decisions are informed by economic, social, and environmental effects and trade-offs. This program will also support and encourage the expansion of vehicle electrification and alternative fuel use through the designation of alternative fuel corridors, technical assistance, training, and research.

This research directly supports the Department's Climate and Sustainability goal. The Resiliency research activity helps address the climate crisis by developing and deploying tools and methods for State and local governments to inform decisions regarding climate impacts on transportation and reducing transportation sector-related GHG emissions. In addition, this research supports agencies investigating a broad range of sustainability goals and objectives when making transportation decisions by developing and deploying tools focused on sustainable transportation.

Multimodal Connectivity

The Multimodal Connectivity activity will promote walking and bicycling infrastructure planning, project development, and networks that address the primary goal of Safety, including Safe Routes to School activities and trails. Secondary goals served by the multimodal network connectivity approach are Equity and Climate and Sustainability, as these networks provide affordable transportation with reduced carbon output.

Major Program Objectives:

This research program supports USDOT's strategic goals of Safety, Economic Strength and Global Competitiveness, Equity, Climate and Sustainability, and Transformation. FHWA's mission is to promote safety, mobility, and economic growth while enhancing the quality of life of all Americans. This mission is accomplished through FHWA's leadership, innovation,

oversight, and stewardship that ensures the Nation's roads and highways continue to be among the safest and most technologically sound in the world.

Accelerating Project Delivery

The Accelerating Project Delivery activity supports initiatives and projects to help FHWA improve the environmental review process, coordinate with the public and agencies, and arrive at better environmental outcomes for transportation projects. This effort aligns with the goals of reducing the potential impact of highway infrastructure and operations on the environment, advancing improvements in environmental analysis, reducing the impact of highway runoff on the environment, and improving transportation planning decisionmaking and coordination.

The Accelerating Project Delivery activity supports programs and projects that aim to reduce the potential impact of highway infrastructure and operations on individuals and communities affected by those programs and projects. Accelerating Project Delivery research also supports relocation planning, real property acquisition cost estimation, design, transportation planning, environmental and civil rights project development review, project-related decisionmaking and coordination, and project budgeting and scheduling.

Performance-Based Planning and Equity

Performance-Based Planning and Equity will apply performance management within the transportation planning and programming processes and work with States and MPOs to achieve desired performance outcomes for a multimodal transportation system. PBPP ensures that transportation investment decisions are made (both in long-term planning and short-term programming of projects) based on their ability to meet established targets. This research will support USDOT's and FHWA's strategic goals and promote more informed decisionmaking that improves transportation planning, programming, operations, and coordination.

Performance-Based Planning and Equity will provide opportunities for communities to participate fully in the highway project decisionmaking process by providing information about the environmental impacts of highway projects and alternatives being considered for each project and identifying innovative and effective mitigation strategies. This activity will provide stakeholders at State DOTs, MPOs, and the public with tools, data, and a regulatory framework to protect human health and the environment. FHWA will also explore and adapt modeling methodologies for transportation planning to allow State DOTs and MPOs to better understand their transportation systems and provide decisionmakers with actionable techniques and tools to better understand how a complex transportation system reacts to investments and policy changes and efficiently make trade-offs between performance metrics.

Modeling and Analysis Tools

The Modeling and Analysis Tools research activity supports USDOT's strategic goals and policy objectives as follows:

- Reduce the potential impact of highway infrastructure and operations on the environment.
- Advance improvements in environmental analyses and processes and context-sensitive solutions for transportation decisionmaking.
- Accelerate construction to reduce congestion and related emissions and improve understanding and modeling of the factors that contribute to the demand for transportation.
- Support investments that encourage safe, equitable, multimodal transportation and strategies to minimize, avoid, or mitigate negative impacts of transportation projects on disadvantaged or overburdened communities.

Improving current air quality and noise modeling tools to produce more accurate and reliable results will provide decisionmakers with the best possible information about the air quality and noise impacts of proposed highway projects when making future infrastructure investment decisions. Accurate predictions of these impacts are critical to engaging the community, understanding the local environment, avoiding costly legal challenges, and supporting innovative infrastructure investments that are vital to the economic growth of the Nation.

Modeling and analytical tools are essential for State DOTs and MPOs to demonstrate to the public that highway projects in their communities do not adversely affect their health and well-being. Developing and deploying new and innovative tools and methods will allow for additional analyses to ensure the protection of human and natural environments.

Resiliency

The Resiliency activity objectives include:

- Developing and deploying tools and methods, promoting best practices, and developing and delivering training to help decisionmakers incorporate climate change resiliency, GHG reduction, and sustainability in transportation plans, projects, and programs.
- Accelerating the adoption of electric and alternative-fueled vehicles by supporting the deployment of fueling and charging infrastructure.
- Conducting training and technical assistance for State DOTs and MPOs.
- Conducting research on best practices, usage, behavior, and stakeholder needs.
- Designating alternative fuel corridors.
- Exploring opportunities to use highway right-of-way to enhance sustainability and reduce GHG emissions, generate additional benefits, and reduce costs that are consistent with operational and safety concerns.

The Resiliency activity directly supports several of the program objectives included in 23 U.S.C. § 503, including studying the vulnerabilities of the transportation system to seismic activities and extreme events and methods to reduce those vulnerabilities; improving transportation planning decisionmaking and coordination; reducing the potential impact of highway infrastructure and operations on the environment; and advancing improvements in environmental analyses and processes and context-sensitive solutions for transportation decisionmaking.

Multimodal Connectivity

Multimodal Connectivity research will improve equitable outcomes in multimodal planning and project development by ensuring safe and efficient mobility choices, including more connected pedestrian and bicyclist options for all users, particularly for communities with underserved populations, including low-income individuals, minority groups, and persons with a disability. This research also will devise strategies for implementing connected active transportation networks that address mobility innovations using emerging technology such as micromobility, shared mobility, and automation. This research will help ensure inclusive multimodal planning, design, and programming to facilitate equitable project delivery outcomes. It will assist partner agencies by providing concise and clear tools, data, methods, performance measures, and other information to maximize economic development and improve quality of life for all users through strategic highway investments.

Anticipated Program Activities:

The Promoting Equity, Strengthening Transportation Planning, and Enhancing Environmental Decisionmaking research program will support the Study on Stormwater Best Management Practices. FHWA, in coordination with the U.S. Environmental Protection Agency (EPA), made a formal offer to enter into an agreement with the TRB to conduct the study. This study will likely be funded in FY 2023, and discussions are ongoing about the cost and scope.

This program also supports the Transportation Access Pilot Program. FHWA will develop and/or procure an accessibility dataset; make the dataset available to requested States, MPOs, and regional transportation planning organizations (RTPOs); and work with the States, MPOs, and RTPOs to assess the change in accessibility. The estimated cost of \$2,550,000 will be funded over multiple years, including in FY 2023. The funds will be used to measure the level of access by surface transportation mode to important destinations, including jobs, healthcare facilities, childcare services, educational and workforce training facilities, housing, food sources, points within the supply chain for freight commodities, domestic and international markets, and connections between surface transportation modes. In 2024, FHWA will develop a report to Congress on the results of the pilot program, including the feasibility of developing and providing periodic accessibility datasets for all States, regions, and localities.

Key FY 2023 FHWA Promoting Equity, Strengthening Transportation Planning, and Enhancing Environmental Decisionmaking R&T Program Activities.

Activity
Accelerating Project Delivery (\$3.285 M)
Performance-Based Planning and Equity (\$2.300 M)
Modeling and Analysis Tools (\$2.300 M)
Resiliency (\$1.423 M)
Multimodal Connectivity (\$1.423 M)

Accelerating Project Delivery

The Accelerating Project Delivery activity will address the evolving environmental policy landscape. FHWA will continue to promote existing successful practices such as the national liaison program, the Project and Program Action Information System (PAPAI), the Interagency NEPA & Permitting Collaboration Tool (INPCT), NEPA Assignment, Planning and Environment Linkages (PEL), and VPI. FHWA continues to support research and outreach related to equity, compliant real-property acquisition, and climate change. FHWA will continue to provide funding for the Center for Environmental Excellence by AASHTO and provide updates on regulation, policy, and guidance.

Performance-Based Planning and Equity

Performance-Based Planning and Equity will support and distribute State and MPO best practices for making investment decisions based on a data-driven PBPP approach and estimate the economic benefits and other cost savings resulting from PBPP. The activity will monitor the effectiveness of PBPP in transportation planning and programming at the State and regional levels and coordinate with key stakeholders to ensure consistent monitoring and documentation of performance measures, targets, and decisionmaking for PBPP. FHWA will apply analytical tools and data resources in the transportation planning decisionmaking process. FHWA will work with States and MPOs to identify notable practices, including multimodal projects that enhance equity, accessibility, and connectivity for all users.

Performance-Based Planning and Equity includes partnering with transportation agencies to develop and deploy best practices, case studies, and other capacity-building activities that support enhanced small, rural, and mid-sized communities and regions. The FHWA stakeholders will continue to receive technical support through the development of training, peer reviews, peer exchanges, workshops, virtual forums, and other mediums that promote planning best practices. The activity will identify innovative visualization methods to analyze, map, present, and report equity information to transportation practitioners, elected officials, and the public. The research will continue to evaluate planning needs in partnership with key stakeholders and identify opportunities and risks of existing procedures to support the continuing, cooperative, and comprehensive planning process. FHWA will partner with key entities (domestic and international) to market emerging products and technologies to meet planning research needs.

Modeling and Analysis Tools

As part of the Modeling and Analysis Tools activity, FHWA will develop and deploy state-of-the-art models and analytical tools to improve data collection methods to enhance air quality, noise, and GHG analyses. A review of the acoustical assumptions in the noise model to enhance the analysis of noise impacts will be initiated, along with identifying innovative mitigation and abatement measures and assessing their effectiveness in reducing emissions and noise impacts. Tools to assist State DOTs and MPOs in assessing air quality and noise impacts at the community level in the near-road environment may also be developed.

Resiliency

The Resiliency activity will partner with State DOTs and others to improve processes, tools, and methods through developmental applied research and demonstration projects for incorporating climate change, extreme events, and natural disaster resilience. FHWA will provide continued support, training, and technical assistance on climate change, extreme event, and natural disaster resilience for highway planning, design, construction, operations and maintenance, and asset management. The program will develop tools and techniques to better inform decisionmaking on GHG emission reductions and sustainability. FHWA will also support expansion of alternative fuels and electric vehicle (EV) charging infrastructure by designating alternative fuel corridors, providing technical assistance and training, and conducting research. Support will be provided to innovative and alternative right-of-way uses, including installing renewable energy generation and providing broadband for additional societal benefits that are consistent with highway operation and safety concerns. Part of the Resiliency activity will be conducting research and supporting the implementation of highway construction and materials that reduce environmental impacts and emissions and maximize material efficiency and recycling.

Multimodal Connectivity

The Multimodal Connectivity activity will promote connectivity practices through a cooperative agreement to operate a national Pedestrian and Bicycle Information Clearinghouse and conduct research through an intra-agency agreement with USDOT John A. Volpe National Transportation Center (herein referred to as Volpe). Other research projects that will support this activity include a task to ensure that new and innovative pedestrian and bicycle facilities are accessible for people with disabilities. Multimodal Connectivity will provide for the administration of the NHS official record and geographic information system (GIS) database to facilitate National Highway Performance Program eligibility determination and NHS system performance tracking. FHWA will research the economic benefits of scenic byways and make the report publicly available as required in the 2021 Consolidated Appropriations Act.

Potential Program Outputs, Outcomes, and Impacts:

Accelerating Project Delivery

Accelerating Project Delivery will support the development of environmental and real property acquisition regulation and policy, reauthorization implementation, project development tools, and collaboration on programs and studies that promote environmental and real property acquisition stewardship and equity in project

development. FHWA will continue to help State DOTs and project stakeholders achieve well-informed environmental outcomes using tools such as INPCT (an interagency collaboration tool that aids project development), PEL (a collaborative approach to bridging project phases), PAPAI (an online tool that helps FHWA monitor project progress), VPI, programmatic agreements, Environment Discipline Support System, and NEPA Assignment support. This activity will fund national liaison initiatives with other Federal agencies to improve cross-agency efficiency and collaboration. This activity will also support the development of tools for streamlining and accelerating real property acquisition initiatives. Finally, Accelerating Project Delivery will support partnerships, such as the Center for Environmental Excellence, with the private sector, research organizations, and State and local governments on research topics such as stormwater permitting, Endangered Species Act compliance, and historic preservation.

Performance-Based Planning and Equity

Performance-Based Planning and Equity research will undertake the following:

- Develop tools, technologies, and guidance to further performance-based planning.
- Offer capacity-building opportunities that plan for and prioritize investments and accelerate project delivery.
- Improve connectivity, accessibility, safety, and convenience for all users, including those in rural areas.
- Promote and maintain a highway infrastructure asset system in a state of good repair.

Additionally, FHWA will consider how various factors, such as revenue constraints, demographic trends, economic shifts, or technological innovation, can affect a State or region and its transportation system performance.

Modeling and Analysis Tools

Modeling and Analysis Tools will be delivered to transportation stakeholders (State DOTs and MPOs) and the public in a variety of ways, such as conferences, workshops, webinars, training courses, peer exchanges, and social media postings. Documents such as research reports, case studies, model sensitivity and validation analyses, and technical guidance will be posted online and marketed at industry events. Research results will also support regulation, guidance, and policy updates.

This research will develop data-driven tools and methodologies to evaluate and demonstrate adequate environmental protections. State DOTs and other stakeholders can use the new and refined analytical tools, data, and other research products to assess air quality and noise impacts and the performance of the highway system and to support evidence-based decisionmaking. These new tools can take advantage of technological advancements and use the latest scientific information to improve accuracy.

With accurate and timely information, States and MPOs can better engage the communities they serve. The effectiveness of mitigation strategies for noise and air quality is complex to evaluate and difficult to quantify. Mitigation of air quality impacts and abatement of noise

impacts are important to ensure that noise and emissions levels are within the standards established in law and, in the case of air quality, to meet established performance measure targets. Research will develop tools to measure the amount of emission and noise-level reductions from existing standard and future innovative mitigation strategies. The tools can also be used to identify and assess effective mitigation and abatement strategies to alleviate impacts for communities near major corridors that face disproportionate exposure to air quality and noise pollution from vehicular traffic.

Resiliency

Expected activity outputs and outcomes include new partnerships with State DOTs and others to reduce GHG emissions; expedite the transition to electric and alternative-fuel vehicles; improve resiliency and sustainability processes, tools, and methods; and develop and deliver technical assistance and training on climate change, emission reduction, energy efficiency, sustainability, and resilience. These efforts would also include training and technical assistance developed and delivered on alternative fuels and EV charging, resulting in expanded national designations of alternative-fuel corridors and the generation of renewable energy in the highway right-of-way. This research provides examples, best practices, tools, and methods for the consideration of resiliency in transportation planning requirements under title 23 CFR § 450 and the integration of resiliency into asset management requirements under title 23 CFR § 515.

Multimodal Connectivity

As Multimodal Connectivity increases in importance in network planning, FHWA will disseminate examples, case studies, and technical assistance resources through topical newsletters, web portals, and other communications channels. Multimodal Connectivity will promote the rebalancing of multimodal investments to address inequalities in underserved communities. The economic benefits of scenic byways, particularly in rural communities, will be identified. Outcomes include an increase in affordable mode choice and more multimodal trips (e.g., walking, biking, and scooting to transit). Improvements in network access analysis will reflect all user's needs for comfort, safety, and mobility to desired destinations. Advances in community impact analysis will bolster plans and projects that support wealth creation and community revitalization.

Potential Economic or Societal Impacts:

Accelerating Project Delivery

Accelerating Project Delivery supports research activities that improve public involvement and the environmental decisionmaking process for transportation projects, leading to better community coordination and, ultimately, better community outcomes. For example, FHWA is developing case studies and fact sheets for VPI, which enhances and broadens the reach of public engagement efforts, including considerations and strategies for engaging traditionally underserved communities. This approach makes participation more convenient, affordable, and enjoyable. When used in combination with traditional public involvement strategies, virtual tools provide increased transparency and access to transportation planning activities and project development and decisionmaking processes. FHWA is developing a case study of the relocation experiences of displaced persons that

will inform FHWA how to better address the problems and challenges faced by persons required to relocate and of communities impacted by Federal-aid projects.

Performance-Based Planning and Equity

Performance-Based Planning and Equity supports research activities that ensure transportation agencies around the country are demonstrating how cooperation across agencies can enhance transportation planning. The transportation system's performance affects public policy concerns, such as safety, air quality, environmental resource consumption, social equity, resilience, land use, urban growth, economic development, and security. Transportation planning recognizes the critical links between transportation needs and other societal goals. It includes strategies for operating, managing, maintaining, and financing the transportation system to advance an area's long-term goals and the regional community's shared vision for the future. This approach requires thinking beyond traditional borders and bringing together many entities to support common goals on transportation planning topics, such as equity, congestion management, safety, freight, and commerce. Performance-Based Planning and Equity activities help improve decisionmaking, save time and money through shared resources, and help agencies achieve more by working together.

Modeling and Analysis Tools

Air quality and noise analyses should consider the effects of a project's air quality and noise level changes within the framework of health, equity, and environmental justice. The regulatory models for these analyses can be complex and difficult to use. FHWA's research aims to develop and update tools and methods that will make the models simpler to use to analyze impacts and mitigation to better serve the public need. In addition, air quality and noise models need to be updated to reflect the most current data and the most up-to-date modeling techniques. This research will ensure that States and MPOs have models that reflect the most recent information and best state-of-the-practice techniques to comply with laws and to assess system performance as accurately as possible. Analyses using these tools and models provide the basis to update air quality and noise regulations, guidance, and policy.

Resiliency

Deployment and implementation of the research tools and techniques under the Resiliency activity will help States and communities anticipate and adapt their infrastructure to account for the future challenges and impacts caused by climate change and extreme weather events, including consideration of the disproportionate impacts on disadvantaged communities. This research will also support the achievement of GHG reduction goals through the application of research tools and techniques to inform transportation projects and program decisions. This research would include the siting and deployment of EV charging infrastructure, the setting and achievement of GHG targets, and the implementation of renewable energy infrastructure in the highway right-of-way.

Multimodal Connectivity

The Multimodal Connectivity activity will promote the rebalancing of multimodal investments to address inequalities in underserved communities. The research will identify the economic benefits of scenic byways, particularly in rural communities. Outcomes include an increase in affordable mode choice and more multimodal trips (e.g., walking, biking, and scooting to transit). Improvements in network access analysis will reflect all users' needs for comfort, safety, and mobility to desired destinations. Advances in community impact analysis will bolster plans and projects that support wealth creation and community revitalization.

Potential Progress Made Toward Achieving Strategic Goals:

Accelerating Project Delivery

Accelerating Project Delivery will help FHWA address the primary strategic goals of Safety, Climate and Sustainability, and Equity, and the secondary goals of Transformation. The Accelerating Project Delivery activity will help FHWA expedite project delivery while ensuring sound environmental stewardship, compliant real property acquisition, and robust public participation in the project development process. This activity supports improving NEPA and compliant real property acquisition processes and improves coordination and communication between Federal and State agencies, the public, and other stakeholders. Additionally, this activity supports capacity building for environmental and real property acquisition practitioners; integrating planning, real property acquisition, and environmental processes; and disseminating information about environment, sustainability, equity, and community engagement.

Performance-Based Planning and Equity

Performance-Based Planning and Equity will help FHWA address the strategic goals of Safety, Economic Strength and Global Competitiveness, Equity, and Transformation. Transportation planning plays a critical role in a State, region, or community's vision for its future through the application of performance management. States and MPOs are responsible for setting performance targets for agreed-upon performance measures for the statewide, nonmetropolitan, and metropolitan transportation planning processes. The USDOT is responsible for identifying performance measures related to national highway and transit performance goals that States and MPOs use in setting performance targets. With these national goals as a baseline, States and MPOs may identify additional performance measures and targets that address local community visions and goals.

Modeling and Analysis Tools

Modeling and Analysis Tools can support State DOTs and other agencies in conducting analyses that allow them to engage people and communities to promote safe, affordable, accessible, and multimodal access to opportunities and services while reducing transportation-related disparities, adverse community and environmental impacts, and health effects. Analysis can assess and support investments that expand accessibility to ensure that transportation networks meet the needs of all people, including disadvantaged populations. Modeling and Analysis Tools can support the expansion of transportation options in underserved rural and urban communities and help minimize, avoid, or mitigate negative impacts of transportation projects on disadvantaged or overburdened

communities. FHWA research and initiatives support options to reduce trips and shift trips to climate-friendly vehicles and modes, including promoting active transportation; reducing exposure to harmful emissions and noise impacts on disadvantaged and overburdened communities; and increasing availability and access to clean transportation options, including affordable EVs.

Resiliency

The research produced in the Resiliency activity will build upon past research products by improving and updating tools and techniques and by deploying research tools and methods developed in the past few years. For example, climate resiliency tools developed previously are continually being updated to account for new and developing best practices in the field and more recent climate science developments. Best practices and methods for considering climate effects and estimating GHG emissions from transportation that are nearing completion will require new efforts to deploy and test those tools in the field.

Multimodal Connectivity

Multimodal Connectivity supports the Safety strategic goal through design guides and technical assistance that aids agencies in implementing safer roadway features, including Complete Streets and complete network elements. The Economic Strength and Global Competitiveness goal is supported by documenting the economic benefits of highways, including scenic byways in rural communities. Equity support comes from building capacity to support and implement an equity-focused network that safely integrates multiple modes of travel convenient for all transportation system users. Climate and Sustainability are supported by assisting partner agencies in identifying low-carbon transportation options, including pedestrian, bicycle, and shared micromobility options. Multimodal Connectivity supports Transformation by promoting the rebalancing of multimodal investments to address inequalities in underserved communities.

Collaboration Partners:

Accelerating Project Delivery

Accelerating Project Delivery involves collaboration with Federal partners, State DOTs, nongovernmental entities, and public stakeholders. Volpe provides valuable support to FHWA by developing products and workshops on a variety of topics and assisting with public stakeholder engagement. FHWA maintains agreements with agencies that oversee Federal environmental programs, including the Advisory Council on Historic Preservation, the National Marine Fisheries Service, the U.S. Army Corps of Engineers (USACE), the U.S. Coast Guard, the EPA, and the U.S. Fish and Wildlife Service.

Performance-Based Planning and Equity

Under Performance-Based Planning and Equity, FHWA will collaborate with key stakeholders in formal and informal settings to gather input on planning and environment opportunities and challenges. Key stakeholders include State DOTs, MPOs, RTPOs, pertinent AASHTO planning committees, the Association of Metropolitan Planning Organizations (AMPO), National Association of Regional Councils, National Association of Development Organizations, National Association of Counties (NACo), TRB, universities engaged in planning and environment-related work, and professional organizations such as

the American Planning Association (APA). Interactions with professional research organizations will occur at regular intervals (as often as quarterly). FHWA will also collaborate with nongovernment groups to support planning and environmental decisionmaking.

Modeling and Analysis Tools

FHWA works with diverse stakeholders to share noteworthy practices and accelerate the adoption of innovations and technologies. Collaboration on modeling research regularly involves engaging with key stakeholders in both formal and informal settings to gather input concerning challenges and opportunities that might be addressed, as well as information on work undertaken by other organizations both nationally and internationally. FHWA routinely works across internal offices and other modal administrations within USDOT, including Volpe. FHWA also routinely engages stakeholders, including representatives of individual State DOTs, MPOs, regional planning agencies, pertinent AASHTO committees, AMPO, TRB, universities engaged in related work, and professional organizations such as ITE and APA. Interactions with AASHTO, AMPO, TRB, and professional organizations generally occur at regular intervals (at least annually and as often as quarterly). Other Federal agencies, including EPA and the Centers for Disease Control and Prevention, and other nongovernment groups, such as the Health Effects Institute, partner and contribute to modeling research through both formal (interagency agreements, FACA workgroups) and informal (workshops, modeling staff workgroups) arrangements.

Resiliency

Collaboration on climate resiliency, GHG reduction, and sustainability involve engagement with key stakeholders in both formal and informal settings to gather input concerning research challenges and opportunities that might be addressed through the activity as well as information on work undertaken by other organizations both nationally and internationally. Primary stakeholders include representatives of individual State DOTs and MPOs, FLMAs, pertinent AASHTO committees, and TRB. Interactions with AASHTO, TRB, and professional organizations generally occur at regular intervals (at least annually and as often as quarterly) but are not formally tracked or measured. In addition, resiliency and sustainability research is conducted in coordination and partnership with several other FHWA program offices. Nongovernmental groups also partner with this program. AASHTO provides a stakeholder perspective and collaborates on research projects.

Multimodal Connectivity

FHWA coordinates with internal DOT working groups on a regular basis on environmental justice, bicyclist and pedestrian initiatives, micromobility, human environment, economic development, VPI, planning stakeholders, recreational trails, Safe Routes to School, transportation alternatives, and Complete Streets. Partnerships with nongovernment groups on this research will include AASHTO, TRB, universities (particularly university transportation centers (UTC)) that engage in related work, and professional organizations such as ITE, the Association of Pedestrian and Bicycle Professionals, the National Association of City Transportation Officials, and APA. Interactions with these organizations and key external stakeholders, such as State DOTs, MPOs, and other regional planning agencies, will help gather critical input concerning challenges, opportunities, and lessons learned from existing multimodal planning efforts undertaken by other organizations and inform how the program research can best address current needs.

Reducing Congestion, Improving Operations, and Enhancing Freight Productivity (\$20,838,000)

Program Description:

The United States has invested billions of dollars in building its existing transportation infrastructure; however, when these facilities are congested, the efficient movement of people and goods is disrupted, causing impacts on the economy, climate, and quality of life. Facilities need to be operated well so that the public can use them efficiently and effectively to maximize the value of these investments. The incorporation of more accurate, real-time, and localized data improve the ability to measure current and future conditions and operation of the freight transportation network. R&D carried out for the Reducing Congestion, Improving Operations, and Enhancing Freight Productivity program results in innovative technologies and processes that lead to systemwide improvements in how FHWA, along with State and local agencies, manages and improves the efficiency and reliability of the NHS.

The program primarily supports the Department's strategic goals of Economic Strength and Global Competitiveness and Climate and Sustainability by enabling efficient movement of people and goods across the transportation system using operational strategies that reduce both wasted productivity and wasted energy consumption. These efforts also support the Safety goal by smoothing traffic flow, mitigating disruptions, providing consistent motorist guidance and information about current conditions, and enabling travel choices and safer streets.

Major Program Objectives:

The program invests in topics such as operations strategies to improve equitable mobility and climate change, active management techniques to increase operational resiliency and safety and advance integration of emerging technologies, and freight mobility to enhance the movement of goods supporting economic competitiveness. Equipping State and local transportation agencies to manage and operate the multimodal transportation system effectively allows them to develop a more holistic approach to solving congestion issues and gain the most from their existing transportation network infrastructure and technology investments. This effort results in enhanced safety and options for all users, reduced emissions and fuel consumption, expanded mobility services to underserved communities, and economic improvement through improved and reliable passenger and freight movement.

Anticipated Program Activities:

Program activities require research and specialized attention to comprehend the opportunities and challenges presented by advanced technologies, such as CAVs; understand the operational impacts of nonrecurring event disruptions to develop predictive and real-time decision support systems that facilitate proactive operations; provide tools to determine the best approaches to address traffic problems and support multimodal solutions; help the U.S. freight industry meet the growth in demand in a safe,

responsible, effective, and sustainable way; and build the capability and capacity for operating agencies to optimize safety and system performance through outreach strategies such as capability maturity models, development of procedures and guidance, and T2.

This program also supports the Cybersecurity Tool. FHWA is collaborating with the Transportation Security Administration and the Cybersecurity and Infrastructure Security Agency. Initiatives and resources will be coordinated through a memorandum of understanding for providing a method to assist transportation authorities in identifying, detecting, protecting against, responding to, and recovering from cyber incidents. This work has not yet been funded.

Key FY 2023 FHWA Reducing Congestion, Improving Operations, and Enhancing Freight Operations R&T Program Activities.

Activity
Transportation Systems Management and Operations (\$4.493 M)
<i>MUTCD</i> (\$2.000 M)
Automation and Connectivity (\$6.351 M)
Managing Disruptions to Operations (\$3.066 M)
Freight Management and Operations (\$3.723 M)
Truck Size and Weight (\$1.205 M)

Transportation Systems Management and Operations (TSMO)

This activity includes several categories. The Foundation for Successful Operations initiative continues the development of outreach and training materials and conducts targeted outreach and T2 to advance the state-of-the-practice and improve the capabilities of agencies for developing and delivering TSMO activities. Data-Driven Operations Decisionmaking continues the enhancement of tools and decision support systems for operational/tactical and executive/organizational TSMO decisions by adding functionality for emerging technologies. The Implementing Operations Strategies initiative continues the development of capabilities, tools, and guidance to enable more proactive, dynamic, integrated, and performance-driven management and operations to proactively advance the adoption of Active Transportation and Demand Management and integrated corridor management solutions and strategies.

MUTCD

To meet the requirements of Section 11129 of the BIL, activities will focus on completing and publishing the 11th edition of the *MUTCD*. This effort involves developing regulatory text, preamble, figures and tables, outreach and training, and a *Standard Highway Signs* book. Support will also be provided for the development of a method and tools for setting appropriate speed limits authoritative reference to be used as a single inclusive source of guidance on a variety of engineering, policy, human factors, educational, and enforcement solutions for setting and achieving appropriate posted speed limits for all road users. Other initiatives will involve developing a staff technical reference handbook and procedures and guidance to FHWA divisions on reviewing and approving State *MUTCDs*, supplements, and supplemental documents.

Automation and Connectivity

Automated driving system (ADS)-roadway integration initiatives will be advanced through the development of new strategies and capabilities that can be applied by stakeholders to enable a collective understanding of how to jointly move forward to address challenges to safe and efficient integration. Activities include expanding stakeholder collaboration and establishing roadway environment management capabilities that are focused on ADS-Roadway Integration, such as the access and exchange of data between ADS and roadways. Analysis, modeling, and simulation tools will be advanced through the collection and dissemination of new and existing datasets of on-road observations and experimental data on the behavior of automated vehicles in traffic for future integration into microsimulation programs and analytical processes. Smart infrastructure functions for CDA to improve pedestrian safety and reduce emissions at intersections will be tested and validated on closed-course facilities, and an independent evaluation of benefits will be conducted. Finally, work will continue on a “toolbox” of materials for use by infrastructure owners and operators to plan for the modernization of their transportation management system, including insights into decision support subsystems, developing concepts of operation, and preparing for transitions from legacy systems.

Managing Disruptions to Operations

There are several initiatives being conducted as part of this activity, broken down into four areas of Road Weather Management, Work Zone Management, Traffic Incident Management, and Nonrecurring Event Data Strategic Plan and Framework.

Freight Management and Operations

Key initiatives include Freight Data Integration and Visualization, Freight Flow Models and Tools, Freight Infrastructure Needs Identification and Analysis, Freight Program Delivery and T2, Freight Performance and Mobility Trends, supply chain bottlenecks, freight resilience, and truck parking.

Truck Size and Weight (TSW)

TSW activities include those related to the completion and execution of the FHWA TSW Research Implementation Plan and scoping work in the following areas:

- Weigh-in-motion research projects.
- Harmonization and automation of State oversize/overweight permitting systems.
- Research and review of pilot/escort vehicle operator training.
- Emergency routing.
- Bridge strike research.
- Establishment of a communication platform to inform drivers of temporary changes to allowable vehicle weights on the interstate system during an emergency.

Other initiatives may include the development of enhanced bridge deterioration models that can account for impacts of alternative truck configurations, development of more accurate models that States and others can use to identify impacts of heavy trucks on pavements, analysis of truck types, and safety impact assessments.

Potential Program Outputs, Outcomes, and Impacts:

Program outputs for all the above activities will include research, review, analysis, and management of existing data; enhanced data and models that facilitate performance-based, data-driven analysis and decisionmaking; and tools and organizational support, including training materials and case studies to support stakeholders. The outcomes of all activities will foster the coordination and collaboration necessary to move toward implementing roadway investments that support the program while providing new capabilities and strategies to improve safety as well as contribute to infrastructure preservation. The impacts will improve the reliability of travel and freight movement; provide an overall smarter, cleaner, and safer transportation network for all users; and provide resources that permit States and other stakeholders to incorporate freight infrastructure improvement projects into transportation program delivery.

Potential Economic or Societal Impacts:

The need continues to grow for a transportation system that provides travel options for the effective movement of people and goods that will mitigate congestion impacts on urban areas and allow for increasing freight transportation, especially with a growing awareness of the needs of underserved communities. As consumer technologies (e.g., smartphones, applications, Global Positioning Systems (GPS)) progress, the traveling public expects that transportation agencies will find creative ways to apply these advances to improve their travel experience.

Automation and Connectivity research activities continue to address the challenges of integrating vehicles with ADS with the road infrastructure system and taking advantage of connectivity to improve the safety, efficiency, and equity of the highway transportation system. Maintaining and updating the *MUTCD* in a timely manner is necessary to reflect current and forthcoming needs of practitioners and road users as well as to accommodate ADS. The Managing Disruptions to Operations activities improve resiliency and organizational preparedness to deal with nonrecurring events and associated disruptions to transportation operations.

The Freight Management and Operations activities seek to better the highway system's physical components—including roads, bridges, pavement, parking facilities, and other elements—that support goods movement. The TSW activities provide Congress, States, and other stakeholders with information to create safe and efficient networks and systems for freight movement across the Nation and international borders.

Potential Progress Made Toward Achieving Strategic Goals:

FHWA continues to develop tools and organizational support to enable agencies to evaluate, plan, fund, design, and quickly capitalize on emerging cost-effective transportation technologies and operational strategies to improve reliability, mobility, safety, and economic competitiveness. The storage, management, and utilization of data acquired from operations projects are providing practitioners with improved tools and techniques for traffic management at various levels and an understanding of how and when

to apply different strategies to reduce congestion, improve operations, and enhance freight movement.

Collaboration Partners:

Both internal and external partners play a valuable role in helping to identify research needs and emerging issues, guiding the form and focus of outreach and technical assistance efforts to share the results of research and encourage its implementation, and providing real-world feedback on implementation results. FHWA, in collaboration with ITS JPO, other USDOT modes, State and local public agencies (LPAs), academia, industry, and other surface transportation stakeholders, continues R&D efforts. Input from external partners is gained through conference sessions and discussions (e.g., TRB, ITE, and AASHTO annual conferences); technical committees and working groups (e.g., TRB committees and AASHTO subcommittees); technical project panels; reviews of partner research reports and plans; workshops and technical assistance to States, MPOs, and regional agencies; and FHWA division office interactions with their State counterparts. Internally, collaboration occurs on key topics of mutual interest through joint review of research products and research ideas, participation in project panels, and periodic coordination meetings.

Accelerating the Implementation and Delivery of New Innovations and Technologies **(\$97,379,000)**

Program Description:

Accelerating the Implementation and Delivery of New Innovations and Technologies encompasses a variety of initiatives and activities that seek to address all aspects of highway transportation, including planning, financing, operation, structures, materials, pavements, environment, construction, and the duration of time between project planning and project delivery.

Within this program, FHWA supports numerous T2 efforts to accelerate the implementation and delivery of new innovations and technologies that result from highway R&D and that benefit all aspects of highway transportation. FHWA will continue to use a series of successful deployment vehicles in FY 2023, including the following:

- EDC, a State-based model for deployment of market-ready but underutilized technologies that make the transportation system adaptable, sustainable, equitable, and safer for all.
- AID Demonstration discretionary grant activity.
- AMR activity to support technologies emerging into the transportation industry.
- STIC, which facilitates a State-based innovation deployment approach.

FHWA will also continue to work directly with State and local agencies to provide technical assistance and deployment initiatives through the geographically dispersed FHWA Office of Innovation Implementation—Resource Center. FHWA will provide Technology Deployment Support activities including, but not limited to, technical assistance; peer exchanges; innovation/T2; and training in the use of tools and decisionmaking processes that assist divisions, States, and local and other transportation partners in effectively implementing surface transportation programs, projects, and policies.

These activities retain their close connection to, and support of, the Department's strategic goals. For example, with the current portfolio of innovations in EDC-6 (2021–22), the Safety strategic goal is reflected through the Crowdsourcing for Advancing Operations topic; and the Economic Strength and Global Competitiveness goal is supported by the Strategic Workforce Development, e-Ticketing and Digital As-Builts, and Targeted Overlay Pavement Solutions topics. Economic Strength and Global Competitiveness is also supported by FHWA's work to uncover and expand the use of innovative finance strategies such as debt financing and private investment to increase the efficiency of current and future cashflow and investment. Another example of this connection with the USDOT strategic goals is the AID Demonstration activity, which enables the piloting of transportation innovation in all aspects of highway transportation, including planning, financing, operation, structures, materials, pavements, environment, and construction.

Accelerating the Implementation and Delivery of New Innovations and Technologies also includes initiatives directed at accelerating the implementation and deployment of

pavement technologies; ADCMS; and deploying advanced technologies and related strategies to improve safety, mobility, efficiency, system performance, intermodal connectivity, and infrastructure return on investment. FHWA is also working to develop and deploy Innovative Finance tools to maximize the ability of States to leverage Federal capital, attract new sources of funds to transportation investment, accelerate project completion dates, and more effectively utilize existing funds.

Major Program Objectives:

Accelerating the Implementation and Delivery of New Innovations and Technologies in FY 2023 includes the launch of the seventh cycle of EDC (EDC-7). The process will identify the portfolio of innovations that are proven, market-ready, and transformative and that are adaptable, sustainable, equitable, and safer for all. EDC-7 will facilitate the adoption of innovative technologies by the surface transportation community.

The EDC-7 innovations also will be closely connected to the Department’s strategic goals. The AID Demonstration and STIC Incentive activities will continue to complement EDC by providing additional resources to help the surface transportation community accelerate the adoption and standardization of innovative technologies. FHWA will disseminate information on previously awarded AMR projects while soliciting a new group of projects through a Broad Agency Announcement (BAA).

The AIDPT activity coordinates with FHWA Pavement and Materials R&D and the Long-Term Pavement Performance (LTPP) program to provide a coordinated approach to implement research, deploy tools and technologies, and provide guidance to support updated policies. The AIDPT activity focuses on improving the safety, durability, sustainability, and cost-effectiveness of highway pavements and the materials from which highway infrastructure is constructed. The AIDPT activity serves as the implementation and deployment mechanism for innovations from the Pavement and Materials and LTPP research activities.

The primary goal of the ADCMS activity is to transform State DOTs and LPAs by promoting, implementing, deploying, demonstrating, showcasing, supporting, and documenting the application of ADCMS practices, performance, and benefits. ADCMS are digital technologies and processes for managing construction and engineering activities, including systems for infrastructure planning and coordination, design, construction, maintenance, modernization and management, and asset management, including hardware, mobile devices, software, Internet of Things (IoT), and personnel. It also includes the development and support of systems to enhance and share data across an asset’s lifecycle and between organizational silos, also referred to as maximizing interoperability.

Secondary goals include reducing the environmental footprint of construction projects, increasing the availability of technology training and workforce development to build the capabilities of sponsors, and enhancing worker and pedestrian safety resulting in increased transparency.

In addition to the previously mentioned initiatives, the vision for the ATTAIN activity (title 23 U.S.C. § 503(c)(4)) includes providing grants to eligible entities to deploy, install, and operate advanced technologies and related strategies to improve safety, mobility, efficiency, system performance, intermodal connectivity, and infrastructure return on investment. These advanced technologies will be integrated into the routine functions of the location or jurisdiction and play a critical role in helping agencies and the public address their challenges.

Anticipated Program Activities:

Planned Activities for the FY 2023 FHWA Accelerating the Implementation and Delivery of New Innovations and Technologies are listed in the following table. These activities will include demonstration grants to State and local transportation agencies as well as direct and indirect assistance to implement new innovations and technologies.

Key FY 2023 FHWA Accelerating the Implementation and Delivery of New Innovations and Technologies R&T Program Activities.

Activity
EDC (\$7.117 M)
STIC Incentive (\$6.132 M)
AID (\$7.117 M)
AMR (\$2.738 M)
Technology Deployment Support (\$1.800 M)
AIDPT (\$12.000 M)
Accelerated Implementation and Deployment of ADCMS (\$20.000 M)
ATTAIN (\$39.000 M)
Innovative Finance (\$975,000)
Research Infrastructure, Technology Transfer, and Partnerships (\$500,000)

EDC

EDC activities essentially constitute an agencywide T2 effort. FHWA program offices and the FHWA Office of Innovation Implementation—Resource Center provide subject matter expertise to form deployment teams that support the implementation of the innovations commensurate with the desired level of adoption or implementation of each State. The State and local highway agencies are the primary beneficiaries of EDC. Other outputs include, but are not limited to, supporting education materials, case studies, and other products.

STIC Incentive

The FHWA STIC Incentive activity provides resources to help foster a culture for innovation and make innovations standard practice in the States. Through the activity, funding up to \$100,000 per State per Federal FY is made available to support or offset the costs of standardizing innovative practices in a State transportation agency or other public sector stakeholder.

AID

This activity provides funding to support the pilot/demonstration of innovations on projects.

AMR

This activity is intended to stimulate and spur the advancement of emerging and transformative innovations in the transportation industry by matching these innovations to the transportation organizations interested in testing and evaluating them.

Technology Deployment Support

The Technology Deployment Support activity is used by FHWA field units to provide technical and workforce development assistance to State and local agencies and to engage them in using new innovations and technologies.

AIDPT

The AIDPT activity will advance strategies for lowering the embodied carbon of paving mixtures and provide tools and information to quantify these strategies. Performance tests to better characterize the durability of materials and pavements will continue to be deployed and implemented. Implementation activities include providing education and guidance on the use of new tests, support for demonstration and shadow projects (where new technologies are used alongside existing technologies), and other information-sharing opportunities such as peer exchanges and workshops.

Accelerated Implementation and Deployment of ADCMS

Accelerated Implementation and Deployment of ADCMS aims to ensure that highway construction uses best practices and leverages advanced digital techniques to accelerate project delivery and increase the safety and efficiency of highway construction.

ATTAIN

ATTAIN will provide grants to eligible entities to deploy, install, and operate advanced transportation technologies to improve safety, mobility, efficiency, system performance, intermodal connectivity, and infrastructure return on investment. USDOT will share the technology solutions and the lessons learned from the ATTAIN projects with other locations to increase successful deployments and provide widespread benefits to the public and agencies.

Innovative Finance

Innovative Finance includes funding for the FHWA Center for Innovative Finance Support, which provides tools, expertise, and financing to help the transportation community explore and implement innovative strategies to deliver costly and complex infrastructure projects.

Research Infrastructure, Technology Transfer, and Partnerships

This activity will identify best practices, formulate strategies, and engage transportation stakeholders in technology and innovation delivery. The activity will also identify, coordinate, and manage strategies related to intellectual property.

Potential Program Outputs, Outcomes, and Impacts:

The *EDC-6 Summit Summary and Baseline Report* summarizes each current innovation and documents the national implementation goals and associated impacts for each innovation. The key output and performance indicator of the AID Demonstration and AMR activities is the award of project grants and the further sharing of benefits and lessons learned by the awardees. The STIC Incentive activity's outputs include delivering job aids and technical resources, training and education materials (e.g., webinars and workshops), and peer-to-peer information exchanges. Each STIC self-defines the outcome being sought by implementing the innovations and monitoring performance to ensure those outcomes are met. By setting goals, the STIC communicates the expected outcome and results from innovation deployment and encourages successful implementation. The ultimate benefit of each of these complementary efforts is the advancement of a culture of innovation and the adoption of tools and technologies that can save time, more effectively use resources, and enhance safety.

Outputs from the AIDPT activity will be demonstration projects, information disseminated on new technologies and practices, training efforts including workshops and webinars, and technical assistance. Successful outcomes include practitioner training, adoption of new technologies and practices through specification changes, and trial and demonstration projects. Impacts lead to more durable and cost-effective pavements and lower embodied carbon of materials and pavements.

Foremost, FHWA will share the technology solutions and the lessons learned from the R&D projects throughout the highway transportation sector to increase successful deployments and provide widespread benefits to the public and agencies. The activities will be focused on producing outcomes that accelerate the testing, deployment, and implementation of new innovations and technologies throughout the highway transportation sector.

Potential Economic or Societal Impacts:

Benefits achieved will include accelerating the implementation and adoption of innovations and technologies that improve the highway transportation system. For instance, the adoption of advanced digital techniques will accelerate project delivery and increase the safety and efficiency of highway construction. An additional benefit will be the increased engagement of diverse populations through the use of VPI tools in project development and promoting strategies aimed at helping State and local agencies identify, train, and place workers in the contractors' workforce to deliver projects.

Potential Progress Made Toward Achieving Strategic Goals:

Progress advanced through the implementation efforts will outlive the award of individual projects in each program. The solicitation vehicles and communication strategies for promoting these activities will include references and evaluation criteria based on USDOT priorities and strategic goals. FHWA will further ensure that the selection of grant recipients represents diverse geographic areas of the United States, including urban and rural areas.

Collaboration Partners:

Stakeholders for EDC include State DOTs, local governments, Tribes, FLMAs, USACE, private industry, AASHTO, ARTBA, American Council of Engineering Companies, and AGC. These stakeholders provide input to support FHWA's identification and selection of a new collection of EDC innovations every 2 yr. Stakeholders in other initiatives are diverse. The broader the diversity of the transportation industry represented on the individual STICs, the greater the opportunity to be comprehensive in advancing innovation strategically.

FHWA also collaborates with ACPA and NAPA and standard-setting organizations such as ACI and ASTM International. FHWA continues to encourage the participation of the academic/research community as well. For instance, stakeholders for the AMR program include entities eligible to apply for project awards (e.g., State DOTs, academic institutions, and the private sector) and State, local, and Tribal transportation agencies as the AMR technologies move into more widespread practice. For programs providing grants, public and stakeholder input is considered in the development of the annual Notice of Funding Opportunity. The USDOT facilitates a cohort of grant recipients to share implementation lessons learned.

Accelerating the Discovery of Transformational Solutions (\$48,282,000)

Program Description:

The FHWA Accelerating the Discovery of Transformational Solutions program supports strategic investment in transportation infrastructure, safety, operations, planning, policy, and innovation development and deployment. The program monitors legislative developments, helps to coordinate the R&T budget allocation, maintains TFHRC, organizes strategic R&T investment, and provides marketing and communications. FHWA's Office of RD&T is located at TFHRC, a federally owned and operated national research facility in McLean, VA. At TFHRC, staff conducts R&D activities in the areas of infrastructure, operations, and safety. Research in ITS, policy, innovative finance, planning, and the environment is conducted or administered by FHWA offices located at USDOT Headquarters. FHWA engages in R&D to leverage the capabilities of TFHRC to develop technologies and innovations of national importance; develop potentially transformational solutions to improve the durability, efficiency, environmental impact, productivity, and safety aspects of highway and intermodal transportation systems; and support research on nonmarket-ready technologies in consultation with public and private entities.

EAR

The EAR activity is the only funding specifically addressing the need for longer term, higher risk research in highway transportation. EAR funding has a direct impact on the supply of potential technologies and processes necessary for continued industry innovation to meet the challenges of improving the safety, operation, and resilience of the U.S. highway system for years to come. The EAR activity applies proven open and deliberative processes to engage experts within and outside the Department to identify potential research topics among new discoveries in science and technology that may address current and emerging needs of the highway transportation industry. By leveraging the capabilities of TFHRC, the EAR activity brings new capacity in emerging areas to the facility.

SBIR

The SBIR activity is a highly competitive, awards-based activity that encourages domestic small businesses to engage in R&D addressing high-priority research areas within USDOT. SBIR favors research that has the potential for commercialization through products and applications sold to the private sector transportation industry, State DOTs, USDOT, or other Federal agencies. Section 638 of 15 U.S.C. establishes that each year Federal agencies with extramural R&D budgets at the Department level that exceed \$100 million are required to allocate 3.2 percent of their R&D budget to these programs.

SIRC and National Motor Vehicle Per-Mile User Fee Pilot

FHWA is also supporting two activities included in the BIL that aim to address the challenge of the decline in revenues that contribute to the Highway Trust Fund. Through the SIRC and the National Motor Vehicle Per-Mile User Fee Pilot activities, FHWA will identify new solutions and opportunities for revenue collection that may enable the country to adequately fund investments in highway infrastructure into the future, despite

emerging challenges and new mobility options. SIRC will provide grants to States and local agencies.

Major Program Objectives:

The Accelerating the Discovery of Transformational Solutions program will provide leadership, coordination, and support in the administration of the FHWA R&T program to help accomplish the USDOT strategic goals. To accomplish these goals, the program will continue to foster and promote enhanced coordination of highway research among all stakeholders; communicate, publish, market, and disseminate research results to appropriate audiences; coordinate strategic resource allocation; and conduct R&T program evaluations.

Research Infrastructure, Technology Transfer, and Partnerships

The Research Infrastructure, Technology Transfer, and Partnerships activity will maintain and support the operation of TFHRC and the R&T program. The highway R&D relating to emerging highway technology that occurs at TFHRC is focused on addressing research gaps not addressed by FHWA's partners. This activity also supports critical partnerships with other research organizations to ensure that FHWA's R&T efforts are coordinated to address critical needs. Additionally, this program supports marketing and communication efforts to ensure that partners, stakeholders, and the public are aware of research investments and innovations. Finally, this activity provides assistance in the legislative and budget development process related to the R&T program.

EAR

The EAR activity conducts investigations across disciplines and program areas to identify topics where a government investment has the potential for transformative results. The EAR activity regularly screens results from its portfolio of active research projects and vigorously supports efforts to transition results that demonstrate high potential impact to applied research programs. Throughout and across activity processes, FHWA engages experts inside and outside the Federal Government to ensure efforts reflect the most recent advances in science and technology, are well targeted to the needs of the U.S. highway industry, and benefit all travelers.

SBIR

The objective of the SBIR activity is to encourage small businesses to engage in R&D that has the potential for commercialization and meets Federal R&D objectives. The SBIR activity is uniquely positioned to support both the interests of FHWA as well as small businesses. In this respect, the SBIR activity aims to provide essential funding to small businesses with the goal of commercialization of products that align with FHWA and USDOT strategic goals.

SIRC and National Motor Vehicle Per-Mile User Fee Pilot

These two revenue collection programs included in the BIL aim to identify innovative and operationally successful solutions to ensure that the country has dedicated and sufficient funding mechanisms for highway infrastructure investment in the future.

Anticipated Program Activities:

The activities within this program will support T2 across the entirety of the FHWA R&T program; conduct program evaluations; provide marketing, communication, and publication services; maintain critical corporate partnerships; and support TFHRC.

Key FY 2023 FHWA Accelerating the Discovery of Transformational Solutions R&T program activities.

Activity
Research Infrastructure, Technology Transfer, and Partnerships (\$14.830 M)
EAR (\$5.190 M)
SBIR (\$3.262 M)
SIRC (\$15.000 M)
National Motor Vehicle Per-Mile User Fee Pilot (\$10.000 M)

Research Infrastructure, Technology Transfer, and Partnerships

This activity will support T2 across the entirety of the FHWA R&T program; conduct program evaluations; provide marketing, communication, and publication services; maintain critical corporate partnerships; and support TFHRC.

EAR

The EAR activity conducts initial stage investigations; supports early stage, extramural research and intramural research through open solicitations, partnering with other agencies, and placement of postdoctoral researchers in FHWA; and actively works to transition research results toward transformative changes in transportation practice.

SBIR

The SBIR activity will participate in the annual solicitation of topics and support current Phase I, II, and IIB projects. Additionally, the FHWA SBIR activity will continue with the Technology Readiness Level (TRL) Assessments throughout Phase II and IIB projects.

SIRC

The SIRC activity will provide grants to State DOTs, local agencies, or MPOs to demonstrate user-based alternative revenue mechanisms to maintain the long-term solvency of the Highway Trust Fund. The annually awarded grants will be for projects designed to test innovative ways to replace or supplement the Federal gas tax.

National Motor Vehicle Per-Mile User Fee Pilot

The National Motor Vehicle Per-Mile User Fee Pilot activity will demonstrate a national motor vehicle per-mile user fee; establish a Federal System Funding Alternative Advisory Board; and carry out a public awareness campaign regarding a national motor vehicle per-mile user fee. The Secretary of Transportation, in coordination with the Secretary of the Treasury, will test the design, acceptance, implementation, and financial sustainability of a national motor vehicle per-mile user fee designed to restore and maintain the long-term solvency of the Highway Trust Fund.

Potential Program Outputs, Outcomes, and Impacts:

The Accelerating the Discovery of Transformational Solutions program will deliver a variety of products and services that benefit the entirety of the FHWA RD&T program and advance the mission and goals of FHWA and USDOT. This program will facilitate information sharing with critical research partners by providing access to essential research publications, supporting marketing and communication efforts, and maintaining research databases that provide access to legacy materials and new research products. Additionally, this program will provide the necessary technical support and access to facilities for the FHWA RD&T staff to ensure that strategic and innovative solutions are being developed and deployed to the network of transportation partners. This effort includes investing in core research infrastructure at TFHRC to ensure that critical experimental and analytical tools are available to achieve the objectives of the FHWA RD&T program successfully. The development of new research capabilities allows FHWA to investigate and advance emerging technologies to the benefit of the Nation's highway transportation system. Additionally, this program operates and maintains the FHWA Research Library, which provides technical research and publication resources to FHWA researchers. Finally, this program ensures that all research efforts are coordinated and communicated with FHWA's research partners, creating a market of research ideas that reduces duplication and strategically invests FHWA's research funds where they are needed most.

EAR

EAR seeks to demonstrate the potentially transformative nature of advances in basic science and technology for addressing transportation research priorities such as equity or climate change. The program then proactively seeks transition partners that can continue to mature the research results toward practice-ready products.

The EAR activity outputs include the proof of concept of new research methods, development of data or analytic tools, and spread of knowledge of both advances and impediments. Midterm outcomes include continued and broadening investment in R&D, leading to systems or processes ready for pilot applications and public testing. Longer term impacts can be seen in broad changes to practice that establish measurable improvements in highway system safety, reliability, or sustainability.

SBIR

Through the SBIR activity, FHWA aims to advance technologies and make problem-solving innovations available to the end user. FHWA will accomplish this by identifying the most promising new innovations, advancing Phase I and Phase II projects that have a clear path to commercialization, and focusing on market-driven needs. This activity creates a win-win-win opportunity for the Federal Government, small businesses, and the traveling public. The Federal Government advances its strategic goals by investing in promising innovations; small businesses benefit from the ability to pursue a good idea through Federal seed funding and, if successful, the sale of their innovative products and solutions; and the public benefits from innovations in the marketplace that enhance the travel experience.

SIRC and National Motor Vehicle Per-Mile User Fee Pilot

USDOT will facilitate sharing lessons learned among SIRC grant recipients and with other jurisdictions through required reporting. USDOT will gather data to provide a report to Congress in 2024, including results of the SIRC pilot projects and the National Motor Vehicle Per-Mile User Fee Pilot.

Potential Economic or Societal Impacts:

The Accelerating the Discovery of Transformational Solutions program aims to ensure that highway innovation serves to advance the economic competitiveness of the country, address equity concerns, and offer accessible options for all road users through investment in R&D. Additionally, the program will coordinate and disseminate critical research results with partners and stakeholders to ensure that solutions are making an impact in the real world.

SBIR

The SBIR activity provides economic opportunities for domestic small businesses by providing seed funding to invest in the development of innovations that will benefit the traveling public. It is often difficult for small businesses to establish themselves in the crowded transportation R&D market because of the high startup costs and the lack of nontechnical resources such as commercialization support and business services. The SBIR activity offers critical support in these areas and provides dedicated funding streams to alleviate some of the initial risk.

SIRC

The SIRC activity is a discretionary grant program. FHWA will ensure that the selection of grant recipients represents diverse geographic areas of the United States. In addition, grant recipients will be required to address equity.

Potential Progress Made Toward Achieving Strategic Goals:

This program will support all of USDOT's strategic goals by investing in and supporting FHWA's critical R&D activities. Additionally, the program will ensure that research results are appropriately coordinated and delivered to FHWA's partners and stakeholders.

EAR

Through open solicitations and partnering with other agencies such as the National Science Foundation (NSF), the EAR activity plans to support research that takes advances in science and technology and demonstrates the potential for improving transportation for all people in support of equity and transportation resilience in support of climate.

SBIR

The SBIR activity provides opportunities to support all of the USDOT strategic goals. The selection of topics and projects is driven by the opportunity to advance the Department's goals. In particular, the SBIR activity leads to transformation through investment in innovations that can also improve safety, advance economic strength, ensure equity, support climate sustainability, and develop organizational excellence.

Collaboration Partners:

This program will continue to support critical research partnerships. The program will continue to coordinate research program information with TRB and the AASHTO Special Committee on Research and Innovation. Furthermore, through this program, FHWA will continue to coordinate research activities through input into the NCHRP; through engagement with the academic research community, including UTCs; and through international partnerships. Finally, the program will continue to work with State and local partners to coordinate research agendas, particularly through management of the Transportation Pooled Fund Program.

EAR

The EAR activity regularly works with technical experts from across USDOT (Bureau of Transportation Statistics (BTS), Federal Motor Carrier Safety Administration (FMCSA), Federal Aviation Administration, Federal Transit Administration, ITS JPO, and NHTSA) and other agencies to participate in scoping activities by serving on technical review panels for EAR activity investments, technical working groups reviewing ongoing EAR-funded research, and TRL Assessment panels that provide input into the transition of results. Additionally, the EAR activity and the NSF Computer Science and Engineering Directorate signed a memorandum of understanding in 2019 to coordinate research leveraging expertise across different research communities on critical transportation research issues. The EAR activity also coordinates with the U.S. Department of Defense, U.S. Department of Energy (DOE), and the National Aeronautics and Space Administration laboratories, the U.S. Department of Commerce NIST, and the U.S. Department of Homeland Security on specific research topics where there are potential joint benefits. Finally, the EAR activity works closely with UTCs, other leading research universities, Historically Black Colleges and Universities, and other Minority Serving Institutions in scouting new topics, conducting research, and transitioning results. The activity also engages State and local agencies and private industry specifically when assessing the potential for research results to transition to practice.

SBIR

The FHWA SBIR activity is coordinated internally within USDOT, and methods and practices are shared with other modes through Volpe, which administers the SBIR activities for USDOT.

SIRC and National Motor Vehicle Per-Mile User Fee Pilot

USDOT will collaborate with stakeholders regarding the SIRC and National Motor Vehicle Per-Mile User Fee Pilot activities through participation in relevant national trade association meetings and independent peer exchanges. USDOT will also establish a Federal System Funding Alternative Advisory Board to help carry out the goals of the national pilot.

Crosscutting (\$37,240,000)

Program Description:

FHWA's Crosscutting program involves a diverse set of programs that support all the USDOT strategic goals and the objectives of the other six programs outlined in this AMRP. Crosscutting involves RD&T initiatives in Policy Analysis, Global Outreach, HDI, Civil Rights, and Federal Lands Highway. It also allows FHWA to provide special focus each year on legislative mandates, administration priorities, and certain emerging RD&T issues that the Agency would like to accelerate through increased investment.

Major Program Objectives:

Policy Analysis

The primary objective of FHWA's Policy Analysis research is to provide decisionmakers with empirically based assessments of emerging trends and future transportation needs and the potential for Federal policies and strategies to address those needs effectively. Policy Analysis research also studies the policy implications of emerging transportation technologies and explores transportation options to expand accessibility.

Global Outreach

The Global Outreach activity seeks out and adapts existing foreign innovations that could significantly improve highways and highway transportation services in the United States. Binational Relations initiatives facilitate knowledge exchange with a variety of countries by leveraging binational government-to-government partnerships. Multinational Relations initiatives span a wide range of program and research activities, working with entities such as PIARC and the European Union.

HDI

HDI activities focus on enabling the effective and efficient delivery of the Federal-Aid Highway Program. HDI's fuel data ensure the apportionment of Federal funds is carried out per the legislation. HDI's highway inventory, including local roads, enables effective national modeling of infrastructure resilience and various emergency evacuation analyses related to hurricanes and other natural disasters. HDI's effort in data gathering, analysis, and forecasting methods focuses on big data and big data analytics to reveal new transformative ways of doing business at the USDOT and FHWA, with State DOTs, MPOs, and other entities and enterprises. More informative and revealing data are gathered through these new approaches, and more relevant information is extracted while making the data program more cost sustainable.

Civil Rights, Federal Lands Highway, and Emerging/Corporate Needs

FHWA's Civil Rights, Federal Lands Highway, and Emerging/Corporate Needs activities touch on all goals and programs. These RD&T activities support a transportation network that is safe for motorists, wildlife, and vulnerable users. These activities also conduct initiatives to improve infrastructure design and implement durable products that are resilient to extreme weather events and consequential impacts of changed ecology in

public lands. In addition, these RD&T activities support improved planning that will provide for more equitable access to the highway transportation system. They will further deliver transportation traveler information systems for more equitable and reliable access to highway transportation and public lands.

Anticipated Program Activities:

The Crosscutting program supports the Performance Management Data Support Program. FHWA will develop, use, and maintain datasets and data analysis tools to assist MPOs, States, and the Agency itself in carrying out performance management analyses. It is anticipated this program will be funded annually at up to \$10 million dollars each year.

This program also supports research and publication of the biennial *Status of the Nation’s Highways, Bridges, and Transit: Conditions and Performance Report to Congress (C&P Report)*. FHWA will expand the required scope of the existing biennial *C&P Report* to include conditions and performance of ITS, resiliency needs, and tunnel needs. This program was fully funded in FY 2022 at \$1,250,000, and work will continue in future years.

Additionally, the Crosscutting program supports the HCAS. FHWA, in coordination with State DOTs, will carry out an HCSA to determine the direct costs of highway use by various types of users (vehicles with different dimensions, weights, number of axles, and other specifications). This effort was fully funded in FY 2022 at \$7 million, and work will continue in future years.

Planned Activities for the FY 2023 FHWA Crosscutting program are listed in the following table. These activities will include R&D initiatives as well as T2 initiatives.

Key FY 2023 FHWA Crosscutting Program Activities.

Activity
Policy Analysis (\$4.369 M)
Global Outreach (\$734,000)
HDI (\$7.052 M)
Civil Rights (\$900,000)
Federal Lands Highway (\$1.687 M)
Emerging/Corporate Needs (\$22.498 M)

Policy Analysis

FHWA Policy Analysis research focuses on developing analytical tools and studies identifying current and emerging issues with national implications from a systemwide perspective rather than just a program implementation perspective.

Global Outreach

FHWA’s Global Outreach activities focus on three main elements: GBP, Binational Relations, and Multinational Relations. The GBP initiative seeks out and adapts existing foreign innovations that could significantly improve highways and highway transportation services in the United States. Binational Relations facilitate knowledge exchange with a variety of

countries by leveraging binational government-to-government partnerships. Multinational Relations span a wide range of program and research activities, working with entities such as PIARC and the European Union.

HDI

FHWA's HDI activity is crosscutting and multifaceted, supporting all FHWA R&T activities and the delivery of the Federal-Aid Highway Program. The HDI activity consists of initiatives to develop and improve data methods and guidelines, and collect, process, analyze, model, visualize, and disseminate data and information by working with States, local transportation agencies, private businesses, and research communities.

Civil Rights

Civil Rights RD&T is focused on transforming, protecting, and enhancing the quality of life for all by improving access to a fair and equitable transportation system. The results of the RD&T initiatives are designed to lead the multidisciplinary highway community in ensuring all programs are delivered in a nondiscriminatory manner.

Federal Lands Highway

Federal Lands Highway RD&T activities support FHWA's partnership with FLMAs and Tribes and seek to implement innovative transportation solutions that provide access to and through public lands. These RD&T activities support improved safety and mobility for vulnerable users of public roads, which typically are non-NHS transportation networks and of low ADT. However, large public land holdings are also accessible by roads and adjacent networks that rival, or are included in, the NHS system and have remarkable ADT, such as the Blue Ridge Parkway and the George Washington Parkway.

Emerging/Corporate Needs

Within the Crosscutting program, funds are available for Emerging/Corporate Needs that address new initiatives, accelerate RD&T activities, conduct legislative mandates, encourage cross-discipline and multimodal RD&T, and highlight Administration priorities. Initiatives like Complete Streets, which focuses on safe access for all groups that need to use them, will be advanced in this program. These funds will also be used to research new ways to tackle the climate crisis and promote transportation equity and access. Emerging/Corporate Needs will also conduct RD&T initiatives to prepare for the widespread integration of CAVs on the highways.

The Complete Streets initiative received funding in FY 2022 and FY 2023 and will complete the development of a safety analysis approach and begin testing the approach with case studies developed by other parties. Work will also proceed on developing methods for reducing data collection costs for pedestrians, bicyclists, and other VRUs. Other work will create a primer that examines the operations aspects of Complete Streets. Further research into policy impacts will consider the implementation and policy choices.

In FY 2022, Emerging/Corporate Needs funds were also used to establish the Climate Challenge Initiative. To demonstrate effective and measurable progress toward the Administration's goals for net-zero emissions, stakeholders must be able to quantify GHG

emissions from materials and practices for the design, construction, and maintenance of pavements. Environmental Product Declarations (EPDs) are a tool used to communicate environmental impacts and quantify GHG emissions from materials and products.

FY 2022 Emerging/Corporate Needs funds were also used to fund programs mandated in BIL, but for which no specific funds were set aside. These programs included: Performance Management Data Support Program (§ 13003), Permeable Pavements Study (§ 11518); *C&P Report* (§ 3006(a)(2)(F)); Highway Cost Allocation Study (HCAS) (§11530), Center of Excellence on New Mobility and Automated Vehicles (§ 13006(c)), Transportation Access Pilot Program (§ 13010), and Vulnerable Road User Research Plan (§ 11122(b)). Research on these initiatives will continue in FY 2023, and funding will also be provided for a Study on Stormwater Best Management Practices (§ 11520) and Cybersecurity Tool (§ 11510). In addition, in FY 2023, initiatives like Complete Streets will receive funding, and funding will continue for the Performance Management Data Support Program (§ 13003), Center of Excellence on New Mobility and Automated Vehicles (§ 13006(c)), and Transportation Access Pilot Program (§ 13010).

Potential Program Outputs, Outcomes, and Impacts:

Policy Analysis

The primary outcome from FY 2023 Policy Analysis research efforts will be improvements to the range and scope of analytical capabilities to support data-driven policy decisionmaking. Key outputs will include the completion of initial development work on the Geospatial Economic Multimodal System (GEMS) model, providing a valuable new tool for analyzing the impacts of alternative transportation options on different types of communities. The Highway Economic Requirements System and National Bridge Investment Analysis System models will be upgraded to support the inclusion of more robust analyses in the 27th *C&P Report* due to Congress in FY 2025. The second edition of a separate biennial Transportation Trends report will also be developed. Economic analyses will be conducted for proposed significant rulemakings agencywide. The HCAS's analytical framework, which forms the scope of the study, will be established with implementation support from a Transportation Pooled Fund. The HCAS, over the course of the study, develops the evaluation principles or criteria for setting future Federal highway user fee options to recommend to Congress, aiding in finding an equitable solution to the solvency of the Highway Trust Fund. The products resulting from Policy Analysis research are used to support USDOT priority programs, including Complete Streets, discretionary grant screening and review, Justice40, and the National Roadway Safety Strategy.

Global Outreach

Outputs from Global Outreach activities will be in the form of successful exchanges with foreign counterparts, reports, guidelines, and other information tools such as webinars, videos, articles, and fact sheets. Global Outreach outcomes accelerate changes that improve the safety and effectiveness of the U.S. highway system; increase the number of available solutions through innovations already proven abroad; and successfully promote U.S. training, approaches, standards, and technologies to foreign counterparts through exchanges and technical assistance. Information obtained from Global Outreach saves research dollars by capturing mature and emerging technologies, policies, and practices;

improves the safety and effectiveness of the U.S. highway system; assists select countries' efforts to improve their highway systems; and supports U.S. foreign policy and relationships. Global Outreach exchanges on GPP will lead to improved tools, methodologies, and best practices that support USDOT's Climate and Sustainability strategic goal, as will exchanges with other countries on infrastructure resilience and connected, automated, and EVs and infrastructure.

HDI

The HDI activity intends to deliver two main categories of outputs. The first output category includes the following:

- Developing improved, new, and innovative data collection, processing, and analysis methods and guidelines related to private passive data in place of the traditional time-consuming and limited coverage data collection methods used by State and local transportation agencies.
- Assessing data representativeness, quality, and cost associated with travel behavior data collection between the online panel member survey method and the traditional addressed-based survey method, as well as identifying potential new approaches.
- Updating *A Guide to Reporting Highway Statistics* and the *Traffic Monitoring Guide* to deploy to State and local agencies.

The second output category includes actual data and information covering:

- Data on 500-Series—Fuel, finance, vehicle, and driver.
- Data on highway performance and monitoring—Infrastructure inventory, including geometrics, travel demand, travel condition, and performance.
- Data on traffic—Volume, class, weight, travel time, vehicle miles traveled, and travel reliability.
- Nonmotorized data—Specifications for nonmotorized (bicyclists, pedestrians, e-scooterists, and e-bicyclists) data formats and nonmotorized infrastructure geospatial locating templates.
- Future national travel demand—Projected future demand on vehicle miles traveled.
- National travel behavior and origin-destination data—Outcomes for these activity-driven outputs will lead to more efficient and effective data collection, processing, and reporting with Federal, State, and local agencies. It will improve data quality and timeliness while making the data program more economically sustainable.

The data outputs will enable the faithful delivery of the Federal-Aid Highway Program according to legislation (e.g., apportionment and performance management) and lay the needed foundation for all R&D activities. The HDI activity impacts the entire Federal-Aid Highway delivery by enabling appropriate Federal-aid apportionments to States, gaining an understanding of the condition and performance of the highways and bridges, utilizing performance management for accountability and transparency, offering practical and efficient tools for State and local use, and promoting a safe and efficient highway system for the public.

Civil Rights, Federal Lands Highway, and Emerging/Corporate Needs

The Civil Rights, Federal Lands Highway, and Emerging/Corporate Needs activities within the FHWA Crosscutting program will deliver a variety of products and services that benefit the entirety of the FHWA RD&T program and advance the mission and goals of FHWA and USDOT. For example, to reduce the number of fatalities and serious injuries on highways and public lands, FHWA will develop and implement roadside hardware, detection systems, and Complete Streets designs. FHWA will also develop real-time decisionmaking tools to identify vulnerable culverts on U.S. Forest Service public lands, which will reduce road overtopping and inundation of sensitive ecological systems and accommodate debris flow caused by wildlife destruction of vegetation on unstable slopes. FHWA will also continue to support the development of datasets for Transportation Access Pilots.

In FY 2023, the Complete Streets initiative will complete the development of a safety analysis approach and begin testing the approach with case studies developed by other parties. Work will also proceed on developing methods for reducing data collection costs for pedestrians, bicyclists, and other VRUs. Other work will create a primer that examines the operations aspects of Complete Streets. Further research into policy impacts will consider the implementation and policy choices.

Potential Economic or Societal Impacts:

Policy Analysis

The measurement of economic impacts is a major focus of FHWA Policy Analysis research and includes analyses of equity-related impacts. Ongoing research on transportation and the economy includes exploration of areas and subgroups for whom the benefits of infrastructure investments have been outweighed by negative impacts in terms of property values. The United States Applied General Equilibrium (USAGE)-Hwy model is being modified to predict the impacts of alternative investment levels on employment for different population subsets, while the GEMS model is being developed to facilitate the evaluation of alternative modal transportation options on different types of communities. Research on emerging trends also supports understanding equity from demographic, income, and location (e.g., rural/urban) perspectives. Policy Analysis research also supports research on the impact of investment on macroeconomic indicators such as gross domestic product, employment, and wages, and on the refinement and application of benefit-cost analysis tools for developing future investment scenarios and predicting the impacts of alternative policies and regulatory initiatives. The HCAS required by BIL will explore equity from a revenue and taxation perspective and analyze the user, agency, and societal costs of highway investments relative to the types of vehicles that are responsible for generating these costs.

Global Outreach

Global Outreach is a valuable tool in identifying, accessing, evaluating, and implementing proven international innovations to address challenges. Activities currently underway include studies and information exchanges with PIARC on issues related to gender inclusion, social equity, and social accessibility. FHWA's involvement in these projects aims to fill in knowledge gaps and obtain information on emerging road-related policies and practices in support of FHWA's priorities related to equity. Discussions are planned with

foreign counterparts to exchange insights regarding advancing equity, as well as sharing U.S. experiences with others. Exchanges regarding climate solutions may lead to reducing the transportation sector's overall carbon footprint.

HDI

The HDI activity serves as the foundation for the Federal-Aid Highway Program and offers data to the entire transportation community. The data enable the assessment of program and policy effectiveness and the efficiencies of various Federal-Aid Highway Programs. Because of the data program, travel among mega-regions and between jobs and leisure among various demographic groups can be analyzed. In addition, private businesses of all sizes, academia, and myriad research entities are also using the HDI data to support their business decisionmaking, promoting economic growth. HDI's travel behavior data are the only publicly available data covering travel behavior and needs, which can be further dissected by race, ethnicity, income, and education. The travel behavior data have offered valuable insights into the USDOT equity analysis.

Civil Rights RD&T investigates and adopts more efficient practices to ensure compliance with anti-discrimination laws. The ADA-related RD&T will have a positive societal impact by maximizing accessibility to pedestrian facilities for people with disabilities.

Federal Lands Highway and Emerging/Corporate Needs

Federal Lands Highway and Emerging/Corporate Needs will promote safety, including reduced collisions with wildlife and development of improved design elements to promote safe and equitable access to transportation. Increased durable assets will extend the lifecycle and need for rehabilitation and replacement at inflated costs for materials. Using improved planning models will result in a wiser investment of limited funds for the right projects at the right time with the right fix and will improve the economic business plans for State DOTs and FLMA partners. Further, finding ways to improve the efficient flow of freight and travelers on public highways and within public lands will reduce congestion and impacts on surrounding ecology. Increased use and awareness of new innovations and technology will provide for improved workforce development and improve the design of projects for more durability and sustainability in the wake of climate change events.

The primary societal benefit from a Complete Streets design model will be in reducing fatalities and serious injuries, which disproportionately affect minority, underserved, and rural communities. Improvements in connected multimodal and low-emission vehicle networks will provide additional economic and social benefits. The multidisciplinary approach toward development of Complete Streets will define new ways of characterizing the additive effects for air quality, quality of life, and reduction of obesity, among others.

Potential Progress Made Toward Achieving Strategic Goals:

Policy Analysis

Analytical models developed as part of Policy Analysis research support a key Departmental performance measure for the Economic Strength and Global Competitiveness strategic goal. Development of GEMS includes different modes of travel and transformative technologies such as micromobilities, EVs, and bicycles. Moreover,

GEMS identifies optimal investment policies considering the underlying transportation supply conditions and specific needs of the demographics in different types of locations in the country, supporting the Department's Equity goal. GEMS minimizes the impacts of policies on climate by considering external costs, such as the environmental costs of any policy. GEMS will eventually be configured to assess the national impact of the Complete Streets initiative, which is integral to the National Roadway Safety Strategy.

Global Outreach

The GBP supports study teams with both implementation expertise and funding to accelerate early implementation activities. A study on the use of UAS to enhance the design, maintenance, inspection, and construction of transportation infrastructure will support the implementation of this transformational technology. Studies on reducing pedestrian fatalities and serious injuries on urban signalized arterials and on turbo roundabouts will be completed, providing implementation strategies in support of USDOT's Safety strategic goal. GBP will also continue activities related to the study on GPP in support of USDOT's strategic goal on Climate and Sustainability. Binational exchanges on GPP may lead to improved tools and methodologies that support the Climate and Sustainability goal, as will exchanges with other countries on infrastructure resilience. Program elements regarding connected, automated, and EVs and infrastructure will contribute to advancing Transformation and Climate and Sustainability goals. Activities with Switzerland, Japan, and Korea regarding bridges and other infrastructure elements will also contribute to the Transformation goal. Exchanges with Sweden, Japan, and Switzerland will advance the Safety goal. FHWA has recently begun exploring a collaborative relationship with the South African National Roads Agency (SANRAL) on developing EV infrastructure and Smart Mobility systems in South Africa.

HDI

The HDI activity has continuously enabled the Federal-Aid Highway Program by providing timely, accurate data. On an annual basis, the HDI data ensure accurate Federal-aid apportionment of Federal funds per the legislative requirements; enable the performance management, including both performance target setting and progress measurement covering safety, travel time reliability, and pavement conditions; and promote data program efficiency among all stakeholders through a strategy of "collecting once and using often." In addition, HDI has been making incremental efficiency and effectiveness improvements in data collection, analysis, and applications in Federal, State, and local governments and private sectors.

Civil Rights

In Civil Rights RD&T, a goal of the ADA team is to remove barriers to accessibility in the public right-of-way. Another goal of the ADA team is to ensure that ADA/504 programs are implemented to prevent and remedy discrimination on the basis of disability. The team is achieving this goal by ensuring that research, technology, and guidance resources are developed to include accessibility for people with disabilities.

Federal Lands Highway and Emerging/Corporate Needs

The breadth of Federal Lands Highway and Emerging/Corporate Needs activities ensure that all the USDOT strategic goals are being addressed.

In particular, Federal Lands Highway implements new technologies and solutions that can be tailored to the needs of roadways under FLMAs. Complete Streets RD&T will develop standards and policies to ensure the safe and adequate accommodation of all users of the transportation system, including pedestrians, bicyclists, public transportation users, children, older individuals, individuals with disabilities, motorists, and freight vehicles.

Collaboration Partners:

Key collaboration partners include State DOTs, MPOs, AASHTO, the AASHTO Research Advisory Committee, the AASHTO Special Committee on Research and Innovation, NCHRP, NSC, the Smart Growth America Coalition, TRB, NACo, AMPO, ARTBA, the American Public Transportation Association, ITE, the American Trucking Associations, the American Association of Retired Persons, and AAA Foundation for Traffic Safety. Additional partners include other industry organizations, research institutes, and institutions of higher education.

Within USDOT, FHWA collaborates with the Office of the Secretary of Transportation, BTS, the Federal Railroad Administration, the Federal Transit Administration, NHTSA, FMCSA, and the Maritime Administration.

FHWA also collaborates with the FLMAs, the DOE, and the U.S. Department of Labor.

Internationally, FHWA collaborates with PIARC, the Forum of European National Highway Research Laboratories, the International Transport Forum, the World Bank, and the Southern African Development Community. Binational relationships currently include Japan, South Korea, the Netherlands, Switzerland, Chile, Australia, Sweden, Canada, Mexico, and Brazil. FHWA has recently begun exploring a collaborative relationship with the South African National Roads Agency SOC Ltd (SANRAL) on the development of EV infrastructure and smart mobility systems in South Africa.

Chapter 2—FY 2024 RD&T Programs

The AMRP FY 2024 outlook year chapter in the annual plan is not developed in alignment with the President’s budget request of the same year due to the AMRP development schedule per 49 U.S.C. Chapter 65 Sec. 6501 Research Planning.

Improving Highway Safety for All Users

Program Description:

The Improving Highway Safety for All Users program primarily supports the USDOT strategic goal of Safety, and, secondarily, the Equity goal by conducting research, developing training, and assisting USDOT’s partners and stakeholders in applying the Safe System Approach with the aim of achieving zero deaths. The program provides support for the HSIP, a core Federal-Aid Highway Program with the purpose of achieving a significant reduction in fatalities and serious injuries on all public roads.

This program also advances the safety engineering work that overlaps traffic engineering, geometric roadway design, transportation planning, and system management and operations. It also aims to help stakeholders reduce fatalities and serious injuries for all users on all public roadways. Further research into data analysis aims to improve State and local safety data systems that commonly record crash, roadway inventory, and traffic volume data. The program also researches the human needs among all roadway users to better understand human behavior and the relationship among all users, infrastructure, and vehicles.

Major Program Objectives:

In FY 2024, the program will continue developing new research, technical assistance, and engagement with stakeholders to advance the Safe System Principles. The program will continue research through PFS to engage State DOTs, other locality partners, and industry associations to define new safety countermeasures and greater precision expressions for such tools. Work with the NCHRP will identify new research activities of interest to the States that can be readily deployed and help reduce the effects of crashes on communities. New engagements and data analytics methods will be identified to help address the scope of equity in the context of safety and start with defining the means to prioritize where safety improvement investments can be made, with equity as a major factor.

Anticipated Program Activities:

Key FY 2024 FHWA Improving Highway Safety for All Users R&T Program Activities.

Activity
Safety Program Delivery
Safety Design and Operations
Safety Data and Analysis
Human Factors Analytics

The Improving Highway Safety for All Users program supports the VRU Research Plan that

will prioritize research on roadway designs, the development of safety countermeasures to minimize fatalities and serious injuries to VRUs, and the promotion of bicycling and walking. Additional funding will be needed in future years to carry out the research and develop the 2-yr update to Congress.

The Improving Highway Safety for All Users program aims to achieve its objectives for 2024 through the following activities.

Safety Program Delivery

This activity will continue to assess FY 2023 State safety performance targets to determine which States met or made significant progress toward their safety targets. Safety Program Delivery activities will provide technical assistance to help State and local agencies effectively manage and administer the HSIP, Strategic Highway Safety Plans, Safety Performance Management, High-Risk Rural Roads, and the Railway-Highway Grade Crossing Safety Improvement Program, among others.

Safety Design and Operations

This activity will promote certain infrastructure-oriented safety treatments and strategies, chosen based on proven effectiveness and benefits, to encourage widespread implementation by State, Tribal, and local transportation agencies to reduce serious injuries and fatalities on the Nation's highways. This activity will collaborate with agencies as they design and operate roadways to fully integrate the needs of all users, accommodate human error, and minimize injury severity.

Safety Data and Analysis

The leading resource for analyzing crash factors over time will be revised in favor of a new architecture that will allow researchers to apply multiple safety datasets at once. In addition, this activity will complete novel data analytics approaches on pedestrian safety that could help overcome certain cost-prohibitive data collection methods. This activity will continue to explore new analysis methodologies, such as interrupted time series and novel datasets, including synthetic data, such as realistic artificial data.

Human Factors Analytics

This activity will continue empirical research using human participants in studies in the Highway Driving Simulator, field research vehicles, and sign laboratory. The work will help promote better and safer traffic control devices and signing, increase pedestrian and bicyclist safety, and facilitate and accelerate the safe integration of emerging ADS technology into the Nation's roadway system in a manner that is safe and acceptable for all roadway users.

Federal Lands Highway also supports safety activities and initiatives through the implementation and T2 of recently completed safety research and the continuation of safety research for VRUs (walking, rolling) in public lands and Tribal communities. FY 2024 safety research technology activities will focus on Safety Data and Analysis, Safety Design and Operations, and Safety Program Delivery. Initiatives will include:

- Wildlife crossing safety: Infrastructure best practices and wildlife crossing detection technology to reduce wildlife-vehicle collisions.
- *Manual for Assessing Safety Hardware*: Updates to include testing for aesthetically pleasing guide rails and bridge railings.

Improving Infrastructure Integrity, Sustainability, and Practices

Program Description:

FHWA's Improving Infrastructure Integrity, Sustainability, and Practices program is a coordinated set of RD&T activities focused on leading, supporting, and enabling improvements in highway infrastructure integrity, sustainability, and practices. The program provides the data, information, and systems required to link Federal transportation investments to improvements in system performance. It delivers tools, technologies, information, and guidelines that highway owners can apply to maintain and improve infrastructure integrity effectively and meet user needs. The leadership and work products provided through FHWA's Improving Infrastructure Integrity, Sustainability, and Practices program are aligned with the USDOT Transformation strategic goal and will contribute to the achievement of the Safety and Climate and Sustainability strategic goals.

Major Program Objectives:

The overarching objective of FHWA's Improving Infrastructure Integrity, Sustainability, and Practices program is to support and enable advances in infrastructure materials, engineering, construction, and management practices to improve infrastructure integrity, safety, and sustainability. The program works to achieve the following:

- Transform infrastructure construction, contracting, and stewardship practices to efficiently achieve long-lasting, resilient infrastructure and safer construction work zones.
- Support and enable improved infrastructure resiliency.
- Develop more durable and sustainable materials.
- Provide guidelines and tools to support the comprehensive lifecycle assessment of infrastructure sustainability.

The Improving Infrastructure Integrity, Sustainability, and Practices program also includes the development and delivery of transformational technologies to substantially improve the durability (and ultimately the sustainability and safety) of bridges. The program also supports the implementation of the updated NBIS and NTIS, thereby ensuring the safety of this critical highway infrastructure. Additionally, FHWA research is delivering the data and information infrastructure owners need to effectively manage pavement and bridge conditions and providing tools, technologies, and guidance to advance the effective management of highway infrastructure and system performance.

Anticipated Program Activities:

Key FY 2024 FHWA Improving Infrastructure Integrity, Sustainability, and Practices R&T Program Activities.

Activity
Construction and Project Management
Geotechnical and Hydraulics
LTIP
Pavements and Materials
Structures
Transportation Performance and Asset Management

Construction and Project Management

This research will pursue advances in construction and contract administration practices for more efficient construction, more effective contract administration, and improved safety for both the construction workforce and the traveling public.

Geotechnical and Hydraulics

This research will develop technical knowledge and advance state-of-the-art engineering technologies and practices to enable more resilient and cost-effective highway infrastructure.

LTIP

LTIP research will continue to expand access to data documenting infrastructure performance and deliver findings derived through analysis of infrastructure performance data.

Pavements and Materials

Pavements and Materials research will continue to explore innovations in materials, test methods, and lifecycle analysis to advance sustainable pavement practices and the use of nontraditional materials.

Structures

Structures research will continue to support the implementation of the updated NBIS and NTIS and pursue innovations in bridge design, preservation, and construction to bring about more durable and cost-effective highway structures.

Transportation Performance and Asset Management

This research will continue to pursue advances to bring about more effective risk-based management of highway system performance.

Federal Lands Highway will support FHWA’s Office of Infrastructure in the areas of lifecycle extension and durable products, such as more durable pavement materials and mix designs and durable concrete and asphalt. Similarly, Federal Lands Highway will advance a bridge lifecycle analysis model to predict asset (structures) deterioration rates

to help prioritize projects based on urgency of need and funding available for its FLMA partners.

Federal Lands Highway will support the development of an asset management prediction model to forecast at-risk culverts for the U.S. Forest Service. Vulnerable culverts are the victim of climate change effects, such as intense precipitation events and wildfires, causing an increase in debris-flow damage to undersized culverts.

Promoting Equity, Strengthening Transportation Planning, and Enhancing Environmental Decisionmaking

Program Description:

In FY 2024, the Promoting Equity, Strengthening Transportation Planning, and Enhancing Environmental Decisionmaking program will carry out research to improve and minimize the cost of transportation planning and environmental decisionmaking processes and to minimize the potential impact of surface transportation on the environment. This program supports many of the USDOT strategic goals.

Accelerating Project Delivery

In FY 2024, the Accelerating Project Delivery activity will continue to help FHWA develop well-informed and environmentally sound transportation projects and programs. It will support FHWA's implementation of NEPA and related environmental requirements through improved coordination and communication between Federal and State agencies, the public, and other stakeholders. In addition, this activity will promote capacity building for environmental practitioners, integration of planning, real property acquisition, environmental processes, and information dissemination.

Performance-Based Planning and Equity

In FY 2024, Performance-Based Planning and Equity will continue to provide a strategic and data-driven approach to transportation decisionmaking that allows agencies to advance transportation planning and PBPP. FHWA will work with States and MPOs to update their measures and targets through long-range transportation plans and transportation improvement programs. This activity will ensure that equity considerations are integrated efficiently into State and MPO transportation plans and projects and improve access and mobility for all users, particularly in underserved populations.

Modeling and Analysis Tools

For FY 2024, the Modeling and Analysis Tools research will continue to focus on developing and deploying new and refined analytical tools. These tools will improve efficiencies and accuracy in support of the delivery of highway projects in consideration of the traveling public's needs and reduce adverse air quality and noise impact on the adjacent communities, including vulnerable populations. FHWA will also continue research on identifying new data sources to ensure necessary analyses remain up to date and protective of the environment. The research activity will assess innovative and effective mitigation and abatement strategies to alleviate impacts on communities near major corridors that face disproportionate exposure to poor air quality and noise pollution from vehicular traffic. The research program will support the USDOT strategic goals on Climate and Sustainability, Equity, Safety, and Economic Strength and Global Competitiveness.

Resiliency

The FY 2024 Resiliency research activity will continue with the same main goals as in FY 2023, which are the development and deployment of tools, techniques, strategies, and methodologies for assessing climate resiliency, GHG emissions, and the efficiency and

sustainability of transportation plans, projects, and programs. However, the FY 2024 program will build on these goals by focusing on the quickly developing technological areas associated with higher level (faster) EV chargers and continuing to fill gaps in the nationwide system of alternative fuel corridors. Climate resiliency efforts will continue to focus on improving resiliency in postdisaster decisionmaking and institutionalizing planning and engineering best practices into standard practices at State DOTs. Resiliency research will also emphasize tool development, technical assistance, and training to better assist State DOTs and MPOs in assessing and evaluating GHG emissions and strategies to reduce emissions.

Multimodal Connectivity

The goals of the FY 2024 Multimodal Connectivity activity are to increase transportation equity; implement a connected multimodal transportation system that provides travelers with improved innovative mobility options, particularly in underserved communities; facilitate economic revitalization; and lower the number of pedestrian and bicyclist fatalities and serious injuries. The activity will also support mobility innovation, active transportation, accessibility planning, context-sensitive design solutions, community impact assessment, and equitable economic development to help address inequalities from transportation disinvestment in underserved communities.

Major Program Objectives:

Accelerating Project Delivery

The Accelerating Project Delivery activity builds tools and collaborates on studies to improve project delivery while ensuring sound environmental stewardship and robust public participation in the project development process and compliant real property acquisition. This activity aligns with the objectives of reducing the potential impact of highway infrastructure and operations on the environment, advancing improvements in environmental analysis, reducing the impact of highway runoff on the environment, and improving transportation planning decisionmaking and coordination.

Performance-Based Planning and Equity

The Performance-Based Planning and Equity activity will allow communities to fully participate in the highway planning and project decisionmaking process by providing information about the anticipated environmental impacts of highway projects and alternatives being considered for each project during the planning process. This effort will provide states, MPOs, and the public with tools, data, and the regulatory framework to protect human health and the environment. Exploring and adapting modeling methodologies for transportation planning also allows State DOTs and MPOs to better understand their transportation systems and provide decisionmakers with actionable techniques and tools to better understand how a complex transportation system reacts to investments and policy changes and efficiently make tradeoffs between performance metrics.

Modeling and Analysis Tools

The objective of the Modeling and Analysis Tools research activity is to identify, develop, and deploy technologies, tools, analysis methods, and performance management

approaches. The goal is to effectively, accurately, and efficiently analyze the impacts of projects on the environment and communities so that transportation projects will be delivered efficiently while maintaining a healthy environment, safeguarding communities, and stimulating economic growth.

Resiliency

Consistent with the objectives of this activity in FY 2023 and operational and safety concerns, the objectives for FY 2024 include the following:

- Developing and deploying tools and methods, promoting best practices, and developing and delivering training to help decisionmakers incorporate climate change resiliency, GHG reduction, and sustainability into transportation plans, projects, and programs.
- Accelerating the adoption of electric and alternative-fueled vehicles by supporting the deployment of fueling and charging infrastructure.
- Conducting training and technical assistance to State DOTs and MPOs.
- Conducting research on best practices, usage, behavior, and stakeholder needs.
- Designating alternative-fuel corridors.
- Exploring opportunities to use highway right-of-way to enhance sustainability and reduce GHG emissions, generate additional benefits, and reduce costs that are consistent with operational and safety concerns.

Multimodal Connectivity

This activity will promote policy that supports the delivery of a nationally connected multimodal transportation system that is safe, equitable, and facilitates economic growth. The research will help transportation agencies build capacity to support and implement an equity-focused network that safely integrates multiple modes of travel and is safe and convenient for all transportation system users. This program will support equitable economic growth and improve multimodal mobility options, including for lower income populations, minorities, and persons with disabilities.

Anticipated Program Activities:

The Promoting Equity, Strengthening Transportation Planning, and Enhancing Environmental Decisionmaking research program will support the Study on Stormwater Best Management Practices. FHWA, in coordination with EPA, made a formal offer to enter into an agreement with the TRB to conduct the study. This study will continue in FY 2024.

This program also supports the Transportation Access Pilot Program. FHWA will develop and/or procure an accessibility dataset; make the dataset available to requested States, MPOs, and RTPOs; and work with the States, MPOs, and RTPOs to assess the change in accessibility. The estimated cost is \$2,550,000 and will be funded over multiple years, including in FY 2022. In 2024, FHWA will develop a Report to Congress on the results of the pilot program, including the feasibility of developing and providing periodic accessibility datasets for all States, regions, and localities.

Key FY 2024 FHWA Promoting Equity, Strengthening Transportation Planning, and Enhancing Environmental Decisionmaking R&T Program Activities.

Activity
Accelerating Project Delivery
Performance-Based Planning and Equity
Modeling and Analysis Tools
Resiliency
Multimodal Connectivity

Accelerating Project Delivery

In FY 2024, FHWA anticipates developing new activities to meet requirements under the BIL and the evolving environmental policy landscape. FHWA expects a heightened need for research and outreach related to equity, compliant real property acquisition, and climate change. In FY 2024, FHWA will continue to promote existing successful practices such as PEL, enhancements to INPCT, VPI, programmatic approaches, NEPA Assignment and audit support, Eco-Logical, resource agency liaison program support, and the Environment Discipline Support System. The Accelerating Project Delivery activity will support updates to regulation, policy, and guidance, particularly as the Council on Environmental Quality and other Federal agencies update their regulations.

Performance-Based Planning and Equity

In FY 2024, the Performance-Based Planning and Equity activity will continue to support the new planning requirements under the BIL and continue to work with States and MPOs to maintain their data/data-driven plans, studies, and priorities and evaluate the effectiveness of their planned transportation improvements. This research will further the ability of States and MPOs to achieve their desired performance outcomes and evaluate and recommend strategies, projects, and programs to transportation decisionmakers based on anticipated systemwide impacts and goals. The Performance-Based Planning and Equity activity will support updates to regulation, policy, and guidance, including housing coordination, human capital/workforce, resiliency, travel demand data and modeling, safety, freight, and more.

Modeling and Analysis Tools

In FY 2024, the Modeling and Analysis Tools research activity will continue to develop and deploy state-of-the-art models, tools, data, and methods to enhance air quality and noise analyses and to support infrastructure investment decisionmaking, the highway project development, and environmental review process. Research products such as analytical tools and models that are completed will be delivered to transportation stakeholders (State DOTs and MPOs) and the public in a variety of ways, such as conferences, workshops, webinars, training courses, and peer exchanges. Documents such as research reports, case studies, model sensitivity and validation analyses, and technical guidance will be posted online and marketed at industry events.

Resiliency

In FY 2024, the Resiliency activity expects to build new and expanded partnerships with State DOTs and others to accomplish the following:

- Institutionalize hydraulic best practices standard design manuals.
- Implement resilience improvements such as nature-based solutions.
- Continue to improve processes, tools, and methods through developmental and applied research and demonstration projects for incorporating resiliency and sustainability.
- Update and enhance technical assistance on resilience for all stages of highway planning, design, construction, operations, maintenance, and asset management.
- Support expansion of alternative fuels through the designation of alternative-fuel corridors, technical assistance, training, and research, continuing to shift focus to new and emerging technologies.

The research will also continue to explore opportunities and support deployment of alternative uses of the highway right-of-way. In addition, Resiliency activities will research and support the implementation of highway construction and materials that reduce environmental impacts and emissions and maximize material efficiency and recycling.

Multimodal Connectivity

In FY 2024, Multimodal Connectivity initiatives are expected to support an equitable, connected multimodal network that integrates safe and efficient mobility options for all users. The activities will further advance transportation equity, promote economic revitalization, integrate emerging mobility technology systems in transportation planning and project development, and promote rebalancing of multimodal investments to address inequalities in underserved communities.

In addition, the Office of Federal Lands Highway notes that transportation systems are critical to maintain and improve the livelihoods of Tribes who are increasingly under threat from extreme weather and climate effects. The Office of Federal Lands Highway supports its FLMA and Tribal partners with the development of prototype, customized asset management models. The *Vulnerability Assessment and Adaptation Framework* funded in FY 2024 will assess the vulnerability of each Tribe's transportation infrastructure by evaluating its exposure, sensitivity, and adaptive capacity in the face of these impacts. This assessment will allow Tribal transportation departments to identify, analyze, and prioritize adaptation options, substantively informing their transportation decisions. The model developed for Tribes has transferability to other FLMA partners.

Reducing Congestion, Improving Operations, and Enhancing Freight Productivity

Program Description:

The United States has invested billions of dollars in building its existing transportation infrastructure; however, when these facilities are congested, the efficient movement of people and goods is disrupted, causing impacts on the economy, climate, and quality of life. Facilities need to be operated well so they are used efficiently and effectively to maximize the value of these investments. Incorporating more accurate, real-time, and localized data improves the ability to measure current and future conditions and operation of the freight transportation network. R&D carried out for the Reducing Congestion, Improving Operations, and Enhancing Freight Productivity program results in innovative technologies and processes that lead to systemwide improvements in how FHWA, along with State and local agencies, manages and improves the efficiency and reliability of the NHS.

The program primarily supports the USDOT strategic goals of Economic Strength and Global Competitiveness and Climate and Sustainability by enabling efficient movement of people and goods across the transportation system using operational strategies that reduce both wasted productivity and wasted energy consumption. These efforts also support the Safety goal by smoothing traffic flow, mitigating disruptions, providing consistent motorist guidance and information about current conditions, and enabling travel choices and safer streets.

Major Program Objectives:

The program invests in topics such as operations strategies to improve equitable mobility and climate change, active management techniques to increase operational resiliency and safety, advanced integration of emerging technologies, and freight mobility to enhance the movement of goods and support economic competitiveness. Equipping State and local transportation agencies to manage and operate the multimodal transportation system effectively allows them to develop a more holistic approach to solving congestion issues and gaining the most from their existing transportation network infrastructure and technology investments. This effort results in enhanced safety and options for all users, reduced emissions and fuel consumption, expanded mobility services to underserved communities, and economic improvement through improved and reliable passenger and freight movement

Anticipated Program Activities:

The Reducing Congestion, Improving Operations, and Enhancing Freight Operations program supports the Cybersecurity Tool. FHWA is collaborating with the Transportation Security Administration and the Cybersecurity and Infrastructure Security Agency. Initiatives and resources will be coordinated through a memorandum of understanding for providing a method to assist transportation authorities in identifying, detecting, protecting against, responding to, and recovering from cyber incidents. This work has not yet been funded.

Key FY 2024 FHWA Reducing Congestion, Improving Operations, and Enhancing Freight Operations R&T Program Activities.

Activity
TSMO
<i>MUTCD</i>
Automation and Connectivity
Managing Disruptions to Operations
Freight Management and Operations
Truck Size and Weight

TSMO

The key FY 2024 activities will continue developing outreach and training materials and conducting targeted outreach and T2 to advance the state-of-the-practice and improve FHWA capabilities for developing and delivering TSMO activities. Tools and decision support systems for operational/tactical and executive/organizational TSMO decisions will be enhanced by adding functionality for emerging technologies. Implementing operation strategies will continue through the development of capabilities, tools, and guidance to enable more proactive, dynamic, integrated, and performance-driven management and operations to proactively advance the adoption of solutions and strategies.

MUTCD

Research undertaken will be related to the implementation of the 11th edition of the *MUTCD*, initial preparation of material for the 12th edition of the *MUTCD* (or equivalent revision to the 11th edition), training on the use of the *MUTCD*, and expanded outreach on the future of the *MUTCD*.

Automation and Connectivity

Planned activities will continue R&D efforts from prior years with the intent to foster the coordination and collaboration necessary to move toward implementing roadway investments that support ADS-roadway integration; provide new modeling capabilities that accurately reflect the impact of the deployment of ADS-equipped vehicles in traffic; and develop, test, and validate CDA capabilities for TSMO strategies.

Managing Disruptions to Operations

In FY 2024, FHWA will continue to actively research, develop, and deploy projects in road weather management, work-zone management, traffic incident management, and nonrecurring event data framework management. Together, these efforts support the USDOT strategic goals and help provide better traveler choices and safer infrastructure.

Freight Management and Operations

Activities will continue to enhance freight-focused performance measurement tools and present national freight performance and mobility measures to understand trends and needs for improvement to the freight transportation system. Other activities include coordinating and investigating truck parking issues; researching the resiliency of the freight transportation system, including through implementing the recommendations of

the USDOT Emergency Route Working Group; and coordinating with FHWA partners on safety and resiliency areas impacting freight, including improvements to data collection methodologies, travel demand models, analysis tools, and strategies to facilitate public-private sector data coordination and sharing.

TSW

The TSW research implementation plan will continue to guide specific resources toward research projects that are topically crosscutting and impact multiple agencies and departments. FHWA will produce resources to determine needed information for freight vehicle size and weight analysis and support harmonization and automation of State permitting systems. FHWA is partnering with stakeholders in the United States and internationally on studies to prevent bridge strikes by trucks and will establish a framework for collecting bridge strike data and use that data to support operational changes and develop countermeasures.

Additionally, Federal Lands Highway is working with the National Park Service to evaluate innovative ways to capitalize on emerging technologies such as mobile devices and big data to help answer key transportation and visitor use questions related to travel patterns, congestion, and other transportation analytics. The Integrating Emerging Traveler Data Collection Methods research includes introducing new methods of capturing traveler data in rural and remote areas absent GPS satellite connection (Wi-Fi/Bluetooth®). Cell panels help collect and transmit data that were unachievable without satellite access. Data captures will inform decisionmaking for identifying projects that achieve congestion reduction in internal (parking lots) and external (gateways) areas of national parks.

Accelerating the Implementation and Delivery of New Innovations and Technologies

Program Description:

Accelerating the Implementation and Delivery of New Innovations and Technologies encompasses a variety of initiatives and activities that seek to address all aspects of highway transportation, including planning, financing, operation, structures, materials, pavements, environment, construction, and the duration of time between project planning and project delivery.

Within this program, FHWA supports numerous T2 efforts to accelerate the implementation and delivery of new innovations and technologies that result from highway R&D and that benefit all aspects of highway transportation. FHWA will continue to use a series of successful deployment vehicles in FY 2024, including the following:

- EDC, a State-based model for deployment of market-ready but underutilized technologies that make the transportation system adaptable, sustainable, equitable, and safer for all.
- AID Demonstration discretionary grant program.
- AMR to support technologies emerging into the transportation industry.
- STIC, which facilitates a State-based innovation deployment approach.

FHWA will also continue to work directly with State and local agencies to provide technical assistance and deployment initiatives through the geographically dispersed FHWA Office of Innovation Implementation—Resource Center. FHWA will provide Technology Deployment Support activities including, but not limited to, technical assistance; peer exchanges; innovation/T2; and training in the use of tools and decisionmaking processes that assist divisions, States, and local and other transportation partners in effectively implementing surface transportation programs, projects, and policies.

Accelerating the Implementation and Delivery of New Innovations and Technologies also includes initiatives directed at accelerating the implementation and deployment of pavement technologies and ADCMS and deploying advanced technologies and related strategies to improve safety, mobility, efficiency, system performance, intermodal connectivity, and infrastructure return on investment. FHWA is also working to develop and deploy innovative finance tools to maximize the ability of States to leverage Federal capital, attract new sources of funds to transportation investment, accelerate project completion dates, and utilize existing funds more effectively.

Major Program Objectives:

EDC

Accelerating the Implementation and Delivery of New Innovations and Technologies in FY 2024 includes the continuation of EDC with EDC-7, which will facilitate the adoption of innovative technologies by the surface transportation community.

The EDC-7 innovations will be closely connected to the USDOT strategic goals. The AID Demonstration and STIC Incentive activities will continue to complement EDC by providing additional resources to help the surface transportation community accelerate the adoption and standardization of innovative technologies in their programs. FHWA will disseminate information on previously awarded AMR projects while soliciting a new group of projects through a BAA.

AIDPT

AIDPT coordinates with FHWA's Pavement and Materials R&D and LTPP to provide a coordinated approach to implement research, deploy tools and technologies, and provide guidance to support updated policies. The AIDPT activity focuses on improving the safety, durability, sustainability, and cost-effectiveness of highway pavements and the materials from which highway infrastructure is constructed. AIDPT serves as the implementation and deployment mechanism for innovations coming out of Pavement and Materials and LTPP research.

ADCMS

The primary goal of the ADCMS activity is to transform State DOTs and LPAs by promoting, implementing, deploying, demonstrating, showcasing, supporting, and documenting the application of ADCMS, practices, performance, and benefits. ADCMS are digital technologies and processes for managing construction and engineering activities, including systems for infrastructure planning and coordination, design, construction, maintenance, modernization and management, and asset management, including hardware, mobile devices, software, IoT, and personnel. It also includes the development and support of systems to enhance and share data across an asset's lifecycle and between organizational silos, also referred to as maximizing interoperability.

Secondary goals include reducing the environmental footprint of construction projects, increasing availability of technology training and workforce development to build the capabilities of sponsors, and enhancing worker and pedestrian safety resulting in increased transparency.

ATTAIN

In addition to the previously mentioned initiatives, the vision for the ATTAIN activity (23 U.S.C. § 503(c)(4)) includes providing grants to eligible entities to deploy, install, and operate advanced technologies and related strategies to improve safety, mobility, efficiency, system performance, intermodal connectivity, and infrastructure return on investment. These advanced technologies will be integrated into the routine functions of the location or jurisdiction and play a critical role in helping agencies and the public address their challenges.

Anticipated Program Activities:

Planned activities for the FY 2024 FHWA Accelerating the Implementation and Delivery of New Innovations and Technologies program are listed in the following table. These activities will include demonstration grants to State and local transportation agencies and direct and indirect assistance to implement new innovations and technologies.

Key FY 2024 FHWA Accelerating the Implementation and Delivery of New Innovations and Technologies R&T Program Activities.

Activity
EDC
STIC Incentive
AID
AMR
Technology Deployment Support
AIDPT
Accelerated Implementation and Deployment of Advanced Digital Construction Management Systems
ATTAIN
Innovative Finance
Research Infrastructure, Technology Transfer, and Partnerships

EDC

EDC activities essentially constitute an agencywide T2 effort. FHWA program offices and the FHWA Office of Innovation Implementation—Resource Center provide subject matter expertise to form deployment teams that support the implementation of the innovations commensurate with the desired level of adoption or implementation of each State. The State and local highway agencies are the primary beneficiaries of EDC. Anticipated activities for FY 2024 include continuation of EDC-7 deployment-related efforts and stakeholder engagement in support of identifying topics for the next 2-yr deployment cycle (EDC-8), which would begin in January 2025.

STIC Incentive

The FHWA STIC Incentive activity provides resources to help foster a culture of innovation and make innovations standard practice in the States. Through the activity, funding up to \$100,000 per State per Federal FY is made available to support or offset the costs of standardizing innovative practices in a State transportation agency or another public sector stakeholder.

AID

The AID Demonstration activity provides funding to support the pilot/demonstration of project innovations.

AMR

The AMR activity is intended to stimulate and spur the advancement of emerging and transformative innovations in the transportation industry by matching these innovations to the transportation organizations interested in testing and evaluating them.

Technology Deployment Support

FHWA field units use the Technology Deployment Support activity to provide technical and workforce development assistance to State and local agencies and to engage them in using new innovations and technologies.

AIDPT

The AIDPT activity will advance strategies for lowering the embodied carbon of paving mixtures and provide tools and information to quantify these strategies. Performance tests to better characterize the durability of materials and pavements will continue to be deployed and implemented. Implementation activities include providing education and guidance on the use of new tests, support for demonstration and shadow projects (where new technologies are used side-by-side with existing technologies), and other information-sharing opportunities such as peer exchanges and workshops.

Accelerated Implementation and Deployment of ADCMS

Accelerated Implementation and Deployment of ADCMS will ensure that highway construction is using best practices and leveraging advanced digital techniques to accelerate project delivery and increase the safety and efficiency of highway construction. The activity will establish and support a BIM-GIS working group. This working group will include key external stakeholders and meet regularly to coordinate and discuss what various groups are doing. ADCMS will also support pooled-fund efforts that advance ADCMS goals and support FHWA Workforce Development activities as related to deployment of digital practices within the highway industry. The initiative will further support FHWA Work Zone Safety activities as related to the deployment of digital practices within the highway industry, BIM implementation/R&D activities based on BIM for Infrastructure Roadmap priority activities, and EDC activities as related to deployment of digital practices within the highway industry. ADCMS will support project sponsors in advancing their UAS initiatives through a continuation of efforts begun under EDC-5 and provide funding to State DOTs and LPAs to advance ADCMS goals and objectives.

ATTAIN

ATTAIN will provide grants to eligible entities to deploy, install, and operate advanced transportation technologies to improve safety, mobility, efficiency, system performance, intermodal connectivity, and infrastructure return on investment. USDOT will share the technology solutions and the lessons learned from the ATTAIN projects with other locations to increase successful deployments and provide widespread benefits to the public and agencies.

Innovative Finance

Innovative Finance includes funding for the FHWA Center for Innovative Finance Support, which provides tools, expertise, and financing to help the transportation community explore and implement innovative strategies to deliver costly and complex infrastructure projects.

Research Infrastructure, Technology Transfer, and Partnerships

This activity will identify best practices, formulate strategies, and engage transportation stakeholders in technology and innovation delivery. The activity will also identify, coordinate, and manage strategies related to intellectual property.

Accelerating the Discovery of Transformational Solutions

Program Description:

The FHWA Accelerating the Discovery of Transformational Solutions program supports the strategic investment in transportation infrastructure, safety, operations, planning, policy, and innovation development and deployment. The program monitors legislative developments, helps to coordinate the R&T budget allocation, maintains TFHRC, organizes strategic R&T investment, and provides marketing and communications. FHWA's Office of RD&T is located at TFHRC, a federally owned and operated national research facility in McLean, VA. At TFHRC, staff conducts R&D activities in the areas of infrastructure, operations, and safety. Research in ITS, policy, innovative finance, planning, and the environment is conducted or administered by FHWA offices located at USDOT Headquarters. FHWA engages in R&D to leverage the capabilities of TFHRC to develop technologies and innovations of national importance; develop potentially transformational solutions to improve the durability, efficiency, environmental impact, productivity, and safety aspects of highway and intermodal transportation systems; and support research on nonmarket-ready technologies in consultation with public and private entities.

EAR

The EAR activity is the only funding specifically addressing the need for longer term, higher risk research in highway transportation. EAR funding directly impacts the supply of potential technologies and processes necessary for continued industry innovation to meet the challenges of improving the safety, operation, and resilience of the U.S. highway system for years to come. The EAR activity applies proven open and deliberative processes to engage experts within and outside USDOT to identify potential research topics among new discoveries in science and technology that may address current and emerging needs of the highway transportation industry. By leveraging the capabilities of TFHRC, EAR brings new capacity in emerging areas to the Center.

SBIR

SBIR is a highly competitive, awards-based activity that encourages domestic small businesses to engage in R&D addressing high-priority research areas within USDOT. SBIR favors research that has the potential for commercialization through products and applications sold to the private sector transportation industry, State DOTs, USDOT, or other Federal agencies. Section 638 of 15 U.S.C. establishes that each year Federal agencies with extramural R&D budgets at the department level that exceed \$100 million are required to allocate 3.2 percent of their R&D budget to these programs.

SIRC and National Motor Vehicle Per-Mile User Fee Pilot

FHWA is also supporting two programs included in the BIL that aim to address the decline in revenues that contribute to the Highway Trust Fund. Through the SIRC and the National Motor Vehicle Per-Mile User Fee Pilot activities, FHWA will identify new solutions and opportunities for revenue collection that may enable the country to adequately fund investments in highway infrastructure into the future, despite emerging challenges and new mobility options. SIRC will provide grants to States and local agencies

Major Program Objectives:

The Accelerating the Discovery of Transformational Solutions program will provide leadership, coordination, and support in the administration of the FHWA R&T program to help accomplish the USDOT strategic goals. To accomplish these goals, the program will continue to foster and promote enhanced coordination of highway research among all stakeholders; communicate, publish, market, and disseminate research results to appropriate audiences; coordinate strategic resource allocation; and conduct R&T program evaluations.

Research Infrastructure, Technology Transfer, and Partnerships

The Research Infrastructure, Technology Transfer, and Partnerships activity will maintain and support the operation of TFHRC and the R&T program. The highway R&D relating to emerging highway technology that occurs at TFHRC is focused on addressing research gaps not addressed by FHWA's partners. This activity also supports critical partnerships with other research organizations to ensure that FHWA's R&T efforts are coordinated and address critical needs. Additionally, this program supports marketing and communication efforts to ensure that partners, stakeholders, and the public are aware of FHWA's research investments and innovations. Finally, this activity aids in the legislative and budget development process related to the R&T program.

EAR

The EAR activity conducts investigations across disciplines and program areas to identify topics where a Government investment has the potential for transformative results. EAR regularly screens results from its portfolio of active research projects and vigorously supports efforts to transition results that demonstrate high potential impact to applied research programs. Throughout and across activity processes, FHWA engages experts inside and outside government to ensure efforts reflecting the most recent advances in science and technology are well targeted to the needs of the U.S. highway industry and benefit all travelers.

SBIR

The objective of the SBIR activity is to encourage small businesses to engage in R&D that has the potential for commercialization and meets Federal R&D objectives. SBIR is uniquely positioned to support both the interests of FHWA as well as small businesses. In this respect, the SBIR activity aims to provide essential funding to small businesses with the goal of commercialization of products that align with FHWA and USDOT strategic goals.

SIRC and National Motor Vehicle Per-Mile User Fee Pilot

These two revenue collection programs included in the BIL aim to identify innovative and operationally successful solutions to ensure that the country has dedicated and sufficient funding mechanisms for highway infrastructure investment in the future.

Anticipated Program Activities:

Key FY 2024 FHWA Accelerating the Discovery of Transformational Solutions R&T Program Activities.

Activity
Research Infrastructure, Technology Transfer, and Partnerships
EAR
SBIR
SIRC
National Motor Vehicle Per-Mile User Fee Pilot

Research Infrastructure, Technology Transfer, and Partnerships

This activity will support T2 across the entirety of the FHWA R&T program; conduct program evaluations; provide marketing, communication, and publication services; maintain critical corporate partnerships; and support TFHRC.

EAR

The activity conducts initial stage investigations; supports early stage, extramural research and intramural research through open solicitations, partnering with other agencies, and placement of postdoctoral researchers in FHWA; and actively works to transition research results toward transformative changes in transportation practice.

SBIR

The SBIR activity is a highly competitive, awards-based program that encourages domestic small businesses to engage in R&D addressing high-priority research areas within USDOT. SBIR favors research that has the potential for commercialization through products and applications sold to the private sector transportation industry, State DOTs, USDOT, or other Federal agencies.

SIRC

The SIRC activity will provide grants to State DOTs, local agencies, or MPOs to demonstrate user-based alternative revenue mechanisms that have the potential to maintain the long-term solvency of the Highway Trust Fund. The annually awarded grants will be for projects designed to test innovative ways to replace or supplement the Federal gas tax.

National Motor Vehicle Per-Mile User Fee Pilot

The National Motor Vehicle Per-Mile User Fee Pilot activity will demonstrate a national motor vehicle per-mile user fee; establish a Federal System Funding Alternative Advisory Board; and carry out a public awareness campaign regarding a national motor vehicle per-mile user fee. The Secretary of Transportation, in coordination with the Secretary of the Treasury, will test the design, acceptance, implementation, and financial sustainability of a national motor vehicle per-mile user fee designed to restore and maintain the long-term solvency of the Highway Trust Fund.

Crosscutting

Program Description:

FHWA's Crosscutting RD&T program involves a diverse set of activities that support all of the USDOT strategic goals and the objectives of the other six programs outlined in this AMRP. Crosscutting involves RD&T activities in Policy Analysis, Global Outreach, HDI, Civil Rights, and Federal Lands Highway. It also allows FHWA to provide special focus each year on legislative mandates, administration priorities, and certain emerging RD&T issues that the Agency would like to accelerate through increased investment.

Major Program Objectives:

Policy Analysis

The primary objective of FHWA's Policy Analysis research is to provide decisionmakers with empirically based assessments of emerging trends and future transportation needs and the potential for Federal policies and strategies to effectively address those needs. Policy Analysis research also analyzes the policy implications of emerging transportation technologies and explores transportation options to expand accessibility.

Global Outreach

The Global Outreach activity seeks out and adapts existing foreign innovations that could significantly improve highways and highway transportation services in the United States. Binational Relations facilitate knowledge exchange with a variety of countries by leveraging binational government-to-government partnerships. Multinational Relations span a wide range of program and research activities, working with entities such as PIARC and the European Union.

HDI

HDI activities focus on enabling the effective and efficient delivery of the Federal-Aid Highway Program. HDI's fuel data ensure the apportionment of Federal funds is carried out per the legislation. HDI's highway inventory, including local roads, enables national effective modeling of infrastructure resilience and various emergency evacuation analyses related to hurricanes and other natural disasters. HDI's effort in data gathering, analysis, and forecasting methods focuses on big data and big data analytics to reveal new, transformative ways of doing business at the USDOT and FHWA, with State DOTs, MPOs, and other entities and enterprises. Through these new approaches, more informative and revealing data are gathered, and more relevant information is extracted while making the data program more cost sustainable.

Civil Rights, Federal Lands Highway, and Emerging/Corporate Needs

FHWA's Civil Rights, Federal Lands Highway, and Emerging/Corporate Needs activities touch on all goals and programs. These RD&T activities support a transportation network that is safe for motorists, wildlife, and vulnerable users. These activities also conduct initiatives to improve infrastructure design and implement durable products that are resilient to extreme weather events and consequential impacts of changed ecology in public lands. In addition, these RD&T activities also support improved planning that will

provide for more equitable access to the highway transportation system. They will further deliver transportation traveler information systems for more equitable and reliable access to highway transportation and public lands.

Anticipated Program Activities:

The Crosscutting program supports the Performance Management Data Support Program. FHWA will continue to develop, use, and maintain datasets and data analysis tools to assist MPOs, States, and the Agency in carrying out performance management analyses. Annual funding of up to \$10 million is anticipated.

This program also supports research and publication of the biennial *C&P Report*. FHWA will expand the required scope of the existing biennial *C&P Report* to include conditions and performance of ITS, resiliency needs, and tunnel needs.

Additionally, the Crosscutting program supports the HCAS. FHWA, in coordination with State DOTs, will continue to carry out an HCSA to determine the direct costs of highway use by various types of users (vehicles with different dimensions, weights, number of axles, and other specifications).

Planned Activities for the FY 2024 FHWA Crosscutting program are listed in the following table. These activities will include R&D initiatives as well as T2 initiatives.

Key FY 2024 FHWA Crosscutting Program Activities.

Activity
Policy Analysis
Global Outreach
HDI
Civil Rights
Federal Lands Highway
Emerging/Corporate Needs

Policy Analysis

FHWA Policy Analysis research focuses on developing analytical tools and studies identifying current and emerging issues with national implications from a systemwide perspective rather than just a program implementation perspective.

Global Outreach

FHWA’s Global Outreach activities focus on three main elements: Global Benchmarking, Binational Relations, and Multinational Relations. The GBP initiative seeks out and adapts existing foreign innovations that could significantly improve highways and highway transportation services in the United States. Binational Relations facilitate knowledge exchange with a variety of countries by leveraging binational government-to-government partnerships. Multinational Relations span a wide range of program and research activities, working with entities such as PIARC and the European Union.

HDI

FHWA's HDI activity is crosscutting and multifaceted, supporting all FHWA R&T activities and the delivery of the Federal-Aid Highway Program. The HDI activity consists of initiatives to develop and improve data methods and guidelines and collect, process, analyze, model, visualize, and disseminate data and information by working with States, local transportation agencies, private businesses, and research communities.

Civil Rights

Civil Rights RD&T is focused on transforming, protecting, and enhancing the quality of life for all by improving access to a fair and equitable transportation system. The results of the RD&T initiatives are designed to lead the multidisciplinary highway community in ensuring all programs are delivered in a nondiscriminatory manner.

Federal Lands Highway

Federal Lands Highway activities support FHWA's partnership with FLMA's and Tribes and seek to implement innovative transportation solutions that provide access to and through public lands. These RD&T activities support improved safety and mobility for vulnerable users of public roads, which typically are non-NHS transportation networks and of low ADT. However, large public land holdings are also accessible by roads and adjacent networks that rival, or are included in, the NHS system and have remarkable ADT, such as the Blue Ridge Parkway and the George Washington Parkway.

Emerging/Corporate Needs

Within the Crosscutting program, funds are available for Emerging/Corporate Needs that address new initiatives, accelerate RD&T activities, conduct legislative mandates, encourage cross-discipline and multimodal RD&T, and highlight Administration priorities. Initiatives like Complete Streets, which focuses on safe access for all groups that need to use them, will be advanced in this program. These funds will also be used to implement new ways to tackle the climate crisis and promote transportation equity and access. Emerging/Corporate Needs will also conduct RD&T initiatives to prepare for the widespread integration of CAVs on the highways.

The Complete Streets initiative in FY 2024 will continue testing a safety analysis approach with case studies developed by other parties. Work will also proceed on developing methods for reducing data collection costs for pedestrians, bicyclists, and other VRUs. Further research into policy impacts will consider the implementation and policy choices.

In FY 2024, initiatives like Complete Streets and initiatives to promote Equity will be funded, and funding for the Performance Management Data Support Program (§13003); Center of Excellence on New Mobility and Automated Vehicles (§13006(c)); and Transportation Access Pilot Program (§13010) will continue.

For More Information on DOT's Research see <https://researchhub.bts.gov/search>.