LEARNING AGENDA

FISCAL YEARS | 2024-2026

U.S. Department of Transportation

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Executive Summary

The U.S. Department of Transportation (DOT)'s *Learning Agenda: FY 2024-2026* is a systematic plan for building evidence to inform policy, regulatory, and operational decisions to make transportation safer, more reliable, sustainable, and affordable for travelers across the Nation. The *Learning Agenda* identifies priority evidence-building needs relevant to DOT programs, policies, and regulations and creates an action plan to address them. It was developed through a robust stakeholder engagement process. It updates and expands the Department's first-ever evidence-building plan: *DOT Learning Agenda: FY 2022-2026*, published in 2022 in accordance with 5 U.S.C. §312. These changes include:

- Adding 17 new topic areas, each with a collection of priority questions that identify some of the Department's most important emerging evidence-building needs in alignment with five of the *FY 2022-2026 DOT Strategic Plan*'s Strategic Goals. The new topic areas include distracted driving, railroad grade crossing safety, aviation surface safety, supply chain disruption, transportation cost burden, safe disposal and transportation of batteries, and EV adoption.
- Sharing findings from the five topic areas that were introduced in the DOT *Learning Agenda: FY 2022-2026* (see Table 1).

DOT's Mission

The Department's mission is to deliver the world's leading transportation system, serving the American people and economy through the safe, efficient, sustainable, and equitable movement of people and goods.

TABLE 1. OVERVIEW OF TOPIC AREAS AND PRIORITY QUESTIONS

Strategic Goal	Topic Area	Priority Question
Safety	Pedestrian and Cyclist Safety (NHTSA, FHWA, OST-R)	• What methods have been shown to be effective for gathering and analyzing information on pedestrians and pedalcyclists' exposure to safety risks? • Which infrastructure and technology solutions are effective in reducing pedestrian crashes and addressing disparities in pedestrian fatalities and injuries? • In what ways do pedestrian and pedalcyclist crashes vary across the population? Which strategies are effective in advancing equity (or reducing inequity) in pedestrian and pedalcyclist crashes? • To what extent might vehicle safety advancements mitigate incidents and injuries to pedestrians and pedalcyclists?
	Distracted Driving (NHTSA)	Which vehicle designs promote and reinforce attentive driving and reduce driver distraction?
	Crash Causal Factors (FMCSA)	What are the key factors that contribute to crashes involving commercial motor vehicles (CMVs)?
	Commercial Motor Vehicle Driver Detention Time (FMCSA)	What is the frequency and severity of detention time experienced by commercial motor vehicle (CMV) drivers and its impact on CMV safety and operations?
	Railroad Grade Crossings (FRA)	Which Federal Railroad Administration (FRA) initiatives have the largest impact on reducing the frequency and severity of highway-rail grade crossing incidents? • Which FRA existing or proposed policies, programs, and interventions effectively persuade the stakeholders of the highest-risk crossings to implement improvements and other initiatives to reduce grade crossing incidents? • What technological solutions effectively and efficiently reduce grade crossing incidents? • To what extent do FRA's grant investments contribute to the reduction of incidents? • To what extent does FRA's partnership with Operation Lifesaver and other stakeholders inform the public about grade crossing safety?
	Aviation Surface Safety (FAA)	How can National Airspace System (NAS) Airports be prioritized for the deployment of Approach Runway Verification (ARV) software to increase situational awareness of surface operations?
	Preventing Unsafe Conditions and Near-Misses from Escalating to Serious Events (OST-R)	• What are the top five near-miss or unsafe conditions in transportation that have the highest likelihood of progressing to serious incidents? • What factors contribute to transportation unsafe/near miss incidents? • Who suffers from transportation related unsafe conditions? • What are effective ways that DOT can reduce the occurrence of unsafe conditions and near miss incidents that lead to transportation related injuries and fatalities?

Strategic Goal	Topic Area	Priority Question
Economic Strength & Global Competitiveness	National Freight Network Modeling (BTS, OST-F)	• How much is freight traffic by mode projected to grow, and how can DOT improve the models that generate these projections? • How can DOT maintain a safe system, considering increased freight volumes? • What network strategies are effective in improving the resilience of our freight infrastructure? • Which improvements to freight infrastructure best support America's path to net-zero emissions? • What are America's core freight transportation assets today? • How well do core freight transportation assets perform, and where do issues exist? • How reliable and well connected is the freight transportation system, considering its multimodal nature and supply chain needs? • To what extent do smaller businesses have equitable or expanding access to the freight system? • What role does the freight system serve in climate justice and environmental justice, and what strategies enable the freight system to support these areas more effectively?
	Establishing a National Multimodal Freight Corridor (OST-F, OST-X)	As the Department works on establishing a National Multimodal Freight Network, what can be learned from how other countries have created similar networks?
	National Maritime Strategy (MARAD)	• What policies, programs, and interventions demonstrate high potential for revitalizing the U.S. merchant marine and maritime industrial base? • What policies, programs, and interventions demonstrate high potential for revitalizing the shipbuilding industrial base? • To what extent are DOT's various approaches effective at supporting the viability of the U.S. flag commercial fleet in international trade and meeting U.S. economic and national security needs?
Equity	Transportation Insecurity (OST-R)	• What is the prevalence of transportation insecurity in the U.S.? • What factors contribute to transportation insecurity? How do the contributing factors vary across demographic and geographic characteristics? • Who suffers from transportation insecurity? How do rates of transportation insecurity vary across demographic and geographic characteristics? • What policies and practices are effective for reducing (or mitigating) transportation insecurity, particularly in areas disproportionately affected? • How is transportation insecurity related to food and housing insecurity?

Strategic Goal	Topic Area	Priority Question
Equity	National Transit Map (FTA)	To what extent are transportation disadvantaged communities served by fixed-route and demand response public transit?
Equity	Transit Oriented Development (FTA)	Was the completion of a Transit Oriented Development (TOD) comprehensive or site-specific planning study associated with an increased likelihood that grantees executed pre-construction activities within three to five years? If so, which types of pre-construction activities (e.g., revised zoning codes, finalized land banking plans, passage of TOD resolutions, completion of long-range transportation improvement plans, or other follow-on actions) had the strongest association?
Climate & Sustainability	Reducing Transportation Greenhouse Gas Emissions (OST-P, All OAs)	- Which DOT strategies are projected to have the largest impact on reducing transportation GHG emissions? - What are reasonable short term reduction targets for the transportation sector to support the economy targets?
Climate & Sustainability	Climate Adaptation and Resilience Strategies (OST-P, All OAs)	Which climate adaptation and resilience strategies are projected to be most effective in protecting transportation assets?
Climate & Sustainability	Sustainable Aviation Fuel (FAA)	What are the environmental benefits and costs of using 100% drop-in sustainable aviation fuel?
Climate & Sustainability	Battery Transportation and Safe Disposal (PHMSA)	Which technologies have been shown to effectively improve the safety of shipping lithium-ion batteries (including batteries ranging from small scale batteries used in consumer electronics to large scale batteries used in electric vehicles) from new batteries to end of life? - Which existing or new technologies have been shown to efficiently and cost effectively measure (for the purposes of enforcement) a battery's state-of-charge, and at what margin of error? - To what extent would the addition of early-warning sensors in battery packaging affect the risk of death or injury from battery incidents? - To what degree would integration of sensors and fire protection into battery packaging affect safety outcomes? - To what extent is existing packaging effective at preventing death/injury from lithium-ion battery incidents? - To what extent do the safety performance characteristics of emerging battery types differ from lithium-ion batteries? - What methods to de-energize end-of-life or damaged batteries have been shown to be safe and cost effective?

Strategic Goal	Topic Area	Priority Question
Climate & Sustainability	Adoption Barriers to EV Market Penetration (OST-R, JOET)	• What is the usage level of electric vehicles (EVs)? • How are EVs used in the United States? • What are the charging patterns of the EVs? • What are the characteristics (demographics or business type) of EV owners? • What is the effectiveness of various incentive efforts? • What are the barriers to EV market penetration and usage in the U.S.? • How do barriers compare to each other with respect to the decision of owning an EV? For example, is range anxiety more a barrier to owning an EV than the availability of charging station? Is EV cost a greater barrier than range anxiety? • To what degree do barriers to EV market penetration and usage vary by type of owner (individual vs. business), socioeconomic and demographic characteristics, and EV charging infrastructure?
Transformation	Safe Integration of Advanced Air Mobility (FAA)	• What do initial Advanced Air Mobility (AAM) operations look like at an early adopter location? • What regulatory/policy changes would be most effective at facilitating the implementation of AAM? • What infrastructure changes will AAM electric vertical takeoff and landing (eVTOL) aircraft operations require? • How and to what extent does do existing regulations and policies inhibit the implementation of cooperative Urban Air Mobility (UAM) operations in the National Airspace System (NAS)? • What data and testing will be needed to support operational, regulatory, and policy changes that allow for the safe incorporation of AAM operations into the NAS?
Findings from DOT Learning Agenda: FY 2022-2026	Drug Impaired Driving (NHTSA)	To what extent does drug impairment play a role in crashes?
	Aviation Weather Cameras (FAA)	What localized characteristics and other factors are associated with significant safety benefits from weather camera services? How are those characteristics distributed across potential locations?
	Demographic Characteristics of DOT Job Applicants (OST-M)	What are the demographics of applicant pools for all DOT occupations?

BACKGROUND

About the U.S. Department of Transportation

The U.S. Department of Transportation (DOT) oversees and administers programs, policies, and regulations to keep the traveling public safe, secure, and mobile while ensuring that our transportation system contributes to the Nation's economic growth.

Through its work to improve the safety and performance of the multi-modal transportation system, DOT touches the lives of every person in the United States and its territories. The Nation's transportation networks and systems include about 4.2 million miles of public roads, 110,000 miles of major railroads, 25,000 miles of commercially navigable waterways, 1.8 million miles of natural gas and oil pipelines, 5,200 public-use airports, and 2,200 transit agencies.[1]

Congress established DOT in 1967, consolidating 31 transportation-related agencies and functions. Approximately 55,000 DOT employees continue to bring innovations and integrity to the work of improving the safety and performance of the multi-modal transportation system.

The Secretary of Transportation provides leadership for the Department and serves as the principal advisor to the President in all matters relating to federal transportation programs. The Office of the Secretary oversees nine operating administrations, each with its own management and organizational structure.

[1] DOT, BTS (2023) *Transportation Statistics Annual Report 2023*, https://doi.org/10.21949/1529944.

Federal Aviation Administration (FAA)

Federal Highway Administration (FHWA)

Federal Motor Carrier Safety Administration (FMCSA)

Federal Railroad Administration (FRA)

Federal Transit Administration (FTA)

Great Lakes St. Lawrence Seaway Development Corporation (GLS)

Maritime Administration (MARAD)

National Highway Traffic Safety Administration (NHTSA)

Pipeline and Hazardous Material Safety Administration (PHMSA)

Evidence Act's Requirements

DOT entered a new paradigm of evidence building with the passage of the *Foundations for Evidence-Based Policymaking Act of 2018*, also known as the Evidence Act.[2] This law redefined how DOT and other Federal agencies build and use data, statistics, and evidence to support strategic and operational decision making. The Evidence Act emphasizes leadership, collaboration, systemic planning, continuous learning, and transparency.

Title I of the Evidence Act requires the 24 Federal agencies specified in the *Chief Financial Officers Act of 1990* to develop four distinct but complementary documents: a Learning Agenda; a Capacity Assessment for Statistics, Evaluations, Research, and Analysis; an Annual Evaluation Plan; and an Evaluation Policy (see Table 2).[3] The Learning Agenda offers a longer-term strategy for identifying priority questions and carrying out related evidence-building activities. The Capacity Assessment analyzes the extent to which the agency has the capacity to undertake the activities outlined in the Learning Agenda and other evidence-

building activities. The Annual Evaluation Plan describes the significant evaluation activities the agency plans to conduct in the following fiscal year. The Evaluation Policy defines and describes the principles that guide the agency's activities throughout the evaluation lifecycle.

DOT published the Learning Agenda: FY 2022-2026, Capacity Assessment, Evaluation Framework in 2022 in conjunction with the FY 2022-2026 DOT Strategic Plan. Since the Evidence Act's passage, DOT also published the FY 2023 Evaluation Plan, FY 2024 Evaluation Plan, and the FY 2025 Evaluation Plan.[4]

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[2] Public Law 115-435

[3] 31 U.S.C. §901; OMB Memoranda M-19-23, M-20-12, and M-21-27 also guide the Evidence Act's implementation and are available at https://www.whitehouse.gov/omb/information-for-agencies/evidence-and-evaluation/

[4] Available at https://www.transportation.gov/budget and https://www.transportation.gov/dot-strategic-plan

TABLE 2. DELIVERABLES REQUIRED UNDER THE EVIDENCE ACT AND RELATED GUIDANCE

	Learning Agenda	Capacity Assessment	Evaluation Policy	Annual Evaluation Plan
Overview	Systematic plan for building evidence to identify and address policy questions relevant to agency's programs, policies, and regulations	Assessment of coverage, quality, methods, effectiveness, and independence of agency's statistics, evaluation, research, and analysis	Define and describe principles to guide agency's activities throughout the evaluation lifecycle	Describes the significant evaluation activities the agency plans to conduct during the FY following the year in which the Plan is submitted
Statute	5 U.S.C. §312(a) and (c) 5 U.S.C. §313(d)(4)	5 U.S.C. §306(a)(9) 5 U.S.C. §313(d)(1)	5 U.S.C. §313(d)(3)	5 U.S.C. §312(b) 5 U.S.C. §313(d)(4)
Time frame	4 Years	4 Years	Perennial	1 Year
DOT Publications	Learning Agenda	Capacity Assessment	Evaluation Framework	FY 2023 Evaluation Plan FY 2024 Evaluation Plan FY 2025 Evaluation Plan

WHAT IS "EVIDENCE"?

The Evidence Act defines evidence as "information produced as a result of statistical activities conducted for a statistical purpose." The implementation guidance for the Evidence Act describes four interdependent components of evidence: foundational fact finding, policy analysis, program evaluation, and performance measurement. These components cover a wide range of activities, largely focused on gathering, analyzing and evaluating information that directly informs operations, policymaking, and regulations.

Evidence-building activities, as applied in the context of the Federal Performance Framework, are a broad set of activities that agencies undertake to expand the available body of facts or information indicating whether a belief or proposition is true or valid. Building evidence can take on many different forms, including policy analysis such as benefit-cost analysis, foundational fact finding such as descriptive studies, and performance measurement such as development or refinement of metrics.[1]

DOT is committed to supporting rigorous, relevant evaluations and to evidence-based strategic and operational decisions that results in continuous improvement across the Department. Under DOT's *Evaluation Framework*, the Department committed to "integrat[ing] the use of evidence into all critical decisions about programs, policies, and regulations. Evidence will serve as a feedback loop in the Department's management and analytical functions[…]Investing in and focusing on the management and use of data and evidence across the Department will support decision makers in investing in high value activities, by linking spending to program outputs, delivering on mission, better managing enterprise risks, and promoting stakeholder engagement and transparency."[2]
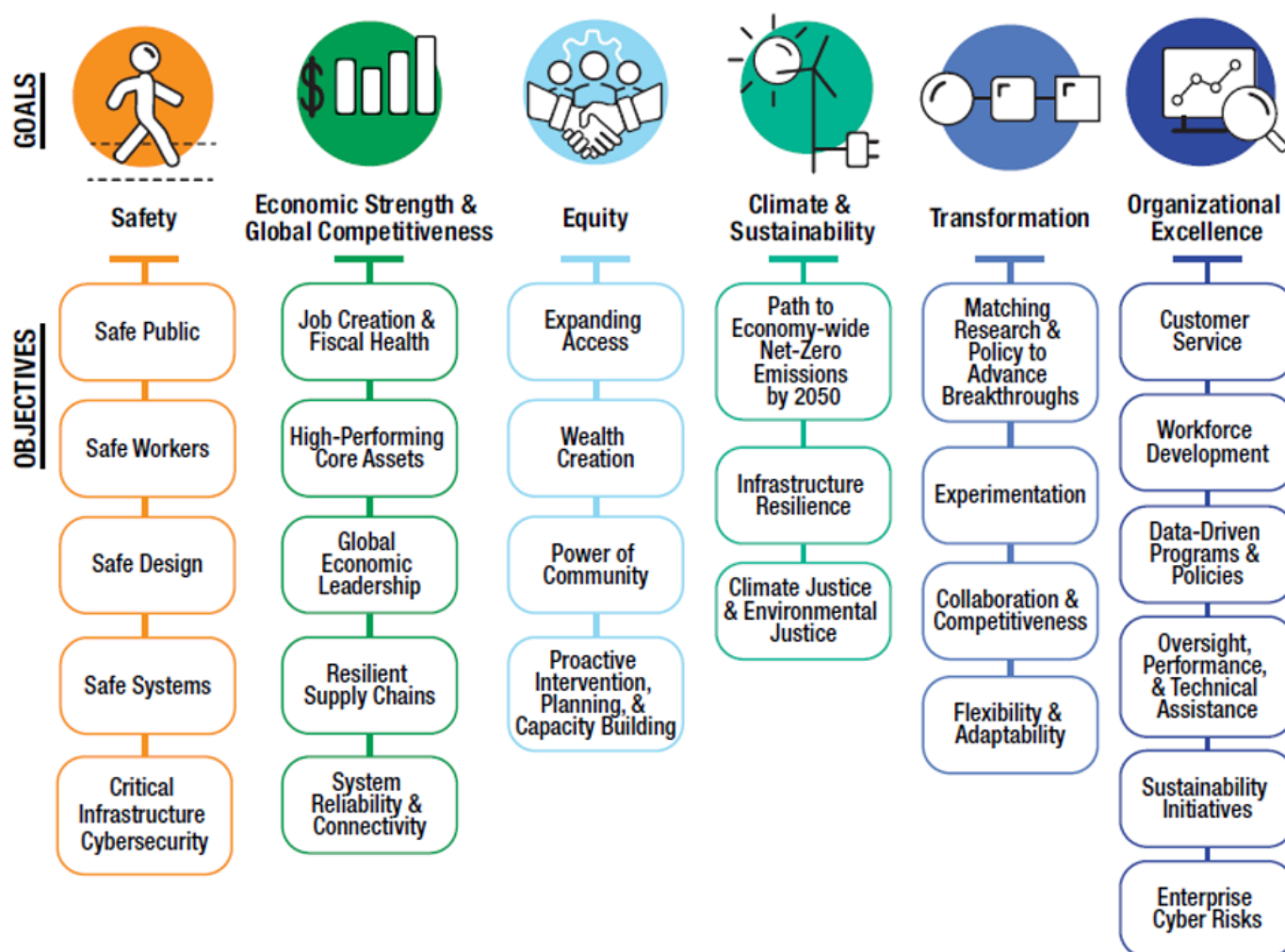
[1] DOT (2022) *Evaluation Framework*, https://www.transportation.gov/mission/budget/evaluation-framework.
[2] OMB (2021), Memorandum M-21-27, https://www.whitehouse.gov/wp-content/uploads/2021/06/M-21-27.pdf.

Alignment with DOT's Mission and Strategic Plan

The _FY 2022-2026 DOT Strategic Plan_ provides the framework for the _Learning Agenda._ The Strategic Plan is a blueprint for advancing the Department's mission to "deliver the world's leading transportation system, serving the American people and economy through the safe, efficient, sustainable, and equitable movement of people and goods." It describes the long-term goals that the Department aims to achieve, the actions that it will take to realize those goals, and how the Department will most effectively use its resources. It does so by identifying six outcome-oriented, long-term Strategic Goals for the Department's major functions and operations. Each Strategic Goal has associated Strategic Objectives, which express more the specific impact DOT is seeking to achieve. The Department also established numerous performance goals that define what success looks like for each Strategic Objective.

GOALS	Safety	Economic Strength & Global Competitiveness	Equity	Climate & Sustainability	Transformation	Organizational Excellence
OBJECTIVES	Safe Public	Job Creation & Fiscal Health	Expanding Access	Path to Economy-wide Net-Zero Emissions by 2050	Matching Research & Policy to Advance Breakthroughs	Customer Service
	Safe Workers	High-Performing Core Assets	Wealth Creation	Infrastructure Resilience	Experimentation	Workforce Development
	Safe Design	Global Economic Leadership	Power of Community	Climate Justice & Environmental Justice	Collaboration & Competitiveness	Data-Driven Programs & Policies
	Safe Systems	Resilient Supply Chains	Proactive Intervention, Planning, & Capacity Building		Flexibility & Adaptability	Oversight, Performance, & Technical Assistance
	Critical Infrastructure Cybersecurity	System Reliability & Connectivity				Sustainability Initiatives
						Enterprise Cyber Risks

The Learning Agenda's 22 Topic Areas

The *Learning Agenda: FY 2024-2026* is a systematic plan for building evidence that will inform policy, regulatory, and operational decisions to make transportation safer, more reliable, sustainable, and affordable for travelers across the Nation. It reflects the Department's current thinking on the appropriate strategies to meet the evidence needs identified; however, these activities may change and are subject to availability of funds.

The *Learning Agenda* contains a total of 22 topic areas from nine of DOT's Operating Administrations. Each of the topic areas poses one or more priority question and provides an action plan for addressing those questions. The *Learning Agenda* is divided into six sections organized around the *FY 2022-2026 DOT Strategic Plan*'s (see Table 1, Figure 1 and 2):

The **Safety** section updates and expand the Pedestrian and Cyclist Safety topic area from the *Learning Agenda: FY 2022-2026*. It also introduces six new topic areas on roadway, rail, and aviation safety, and preventing unsafe conditions and near-misses.

The **Economic Strength and Global Competitiveness** section introduces three new topic areas on the freight and maritime networks.

The **Equity** section introduces three new topic areas on transportation insecurity, transit access, and transit-oriented development.


Figure 1: Structure of the Learning Agenda

The **Climate & Sustainability** updates and expands the Reducing Transportation Greenhouse Gas Emissions topic area from the *Learning Agenda: FY 2022-2026*. It also introduces three new topic areas on resilience, sustainable aviation fuel, and the transportation and safe disposal of batteries.

The **Transformation** section introduces the new advanced air mobility topic area.

The **Findings from the DOT Learning Agenda: FY 2022-2026** section summarizes findings from evidence-building activities that address priority questions introduced in DOT's prior learning agenda, including Drug Impaired Driving, Aviation Weather Cameras, and the Demographic Characteristics of DOT's Job Applicants.

Figure 2: Distribution of Topic Areas by Strategic Goal and Status
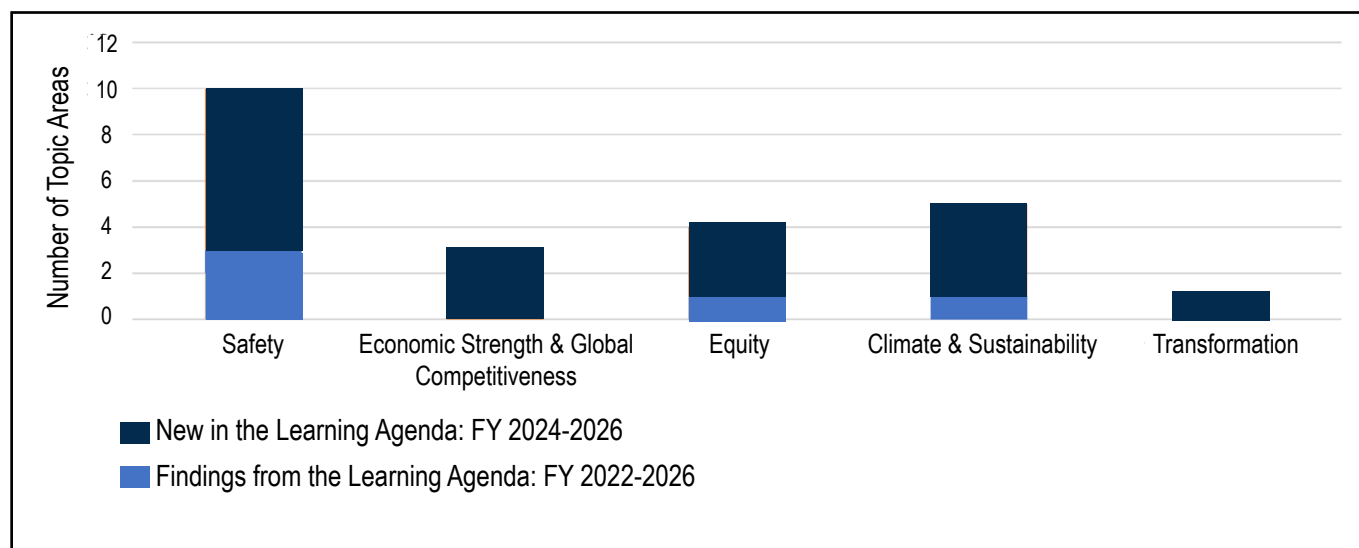
WHAT IS A LEARNING AGENDA?

Federal law defines a learning agenda as a "systematic plan for identifying and addressing priority evidence-gathering needs relevant to programs, policies, and regulations."[1] It offers a roadmap for developing evidence to support policymaking. It serves to "focus agency attention on the evidence needed to solve big problems" aligned with the strategic goals and objectives in the agency's strategic plan.

A learning agenda is a strategic planning tool with two main purposes. First, learning agendas are a vehicle for identifying the agency's most mission-critical policy and operational evidence-building needs, also known as priority questions. Priority questions can be used to tackle issues and challenges that the Department faces but does not fully understand.

Second, a learning agenda is a strategic evidence building plan to answer these tough questions. It sets the course for the Department's ongoing work across research, analysis, and evaluation to build evidence to drive results. By thinking strategically about Departmental evidence needs via the learning agenda, the Department can avoid ad hoc and uncoordinated analytical efforts and the associated inefficient use of resources, so that it can instead prioritize those questions that, when answered, can inform consequential decisions and high-priority functions.

A thoughtful, well-crafted learning agenda that is developed in collaboration with stakeholders within and outside of the Department has the potential to foster a culture of learning and continuous improvement, develop an evidence building plan that can be used to inform budget and policy decisions that drive results, target research and evaluation resources at the agency's most important issues, foster transparency and accountability, and make progress on required actions.[2]

[1] 5 U.S.C. §312(a)
[2] OMB (2021) Memorandum M-21-27 https://www.whitehouse.gov/wp-content/uploads/2021/06/M-21-27.pdf.

Developing the Learning Agenda

DOT reviews and assesses its Learning Agenda on an annual basis in accordance with Section 290.8 of the Office of Management and Budget (OMB) *Circular A-11*.[5] At the midway point of implementing the *Learning Agenda: FY 2022–2026*, the Department determined that developing and issuing a new Learning Agenda would promote learning both within and outside the Department. It would allow DOT to share with the American people the advancements that it has made toward answering its priority questions and address emergent learning needs identified through a robust stakeholder engagement process.

The Department published a request for information in the *Federal Register* on February 13, 2024 to seek contributions from the general public and invite them to engage with DOT's work.[6] The notice sought input on three main areas:

- Whether there were new priority learning questions
- Whether there were new priority data needs
- Whether the learning questions or data needs in the FY 2022 – 2024 Learning Agenda needed to be adjusted

It was developed in consultation with stakeholders across DOT and with guidance from another Federal agency and in accordance with 5 U.S.C §312(c) and Section 290.16 of *Circular A-11*.[7] The Department amplified the notice by publicizing it through DOT's social media accounts, newsletters, and on DOT's intranet. Evaluation.gov's social media accounts also promoted it. During the notice's 60-day comment period, it received eight comments.[8]

The Department also created an opportunity for transportation professionals to inform the *Learning Agenda's* development through the Transportation Research Board (TRB) annual meeting in January 2024. This conference brought together thousands of transportation professionals from around the world. Attendees included researchers, policy makers, and representatives from government, industry, and academic institutions.[9] The Office of

the Secretary's Office of the Assistant Secretary for Budget and Programs and Chief Financial Officer (OST-B) hosted a booth in the conference's exhibition hall where it invited transportation professionals to propose topics for the *Learning Agenda* (see Figure 3). Thirty-two individuals representing government, industry, academic institutions, and nongovernmental organizations submitted topic proposals at this booth.

The process of developing the Learning Agenda sought to break down organizational siloes, facilitate collaboration, foster DOT's culture of learning, and expand the utility of the Learning Agenda across the Department. The internal engagement process extended across all of DOT's Operating Administrations. The Office of the Secretary worked with each Operating Administration

Figure 3: Interactive Posters at the Transportation Research Board Annual Meeting

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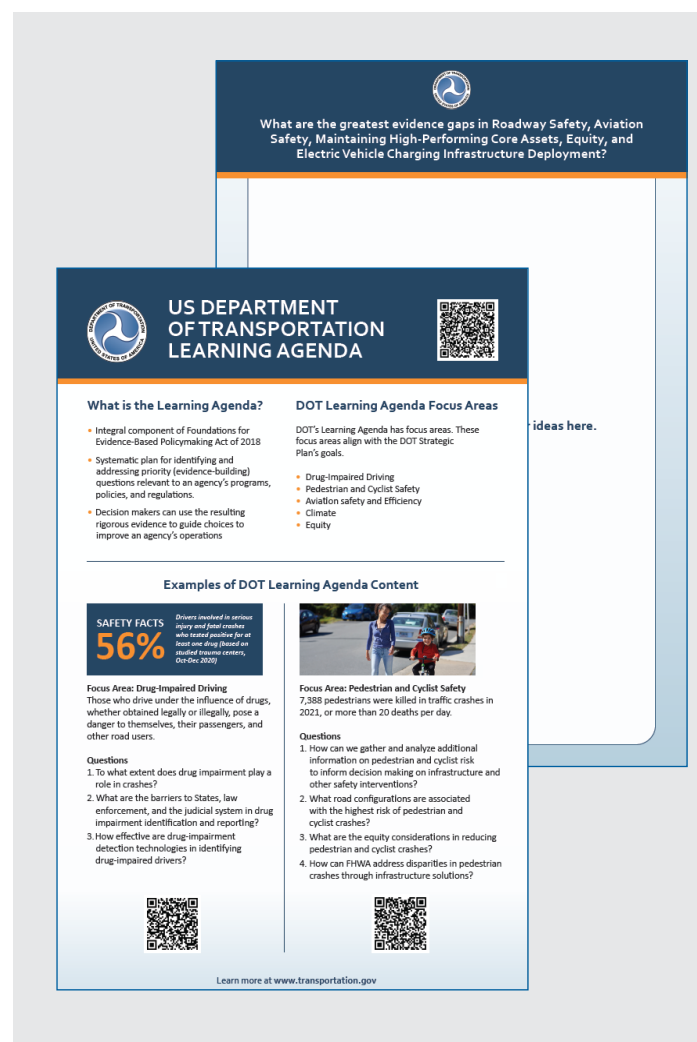
[5] OMB (2024) *Circular A-11* Section 290.8, www.whitehouse.gov/wp-content/uploads/2018/06/s290.pdf. This requirement is also noted in OMB Memorandum M-19-23 and reiterated in OMB Memorandum M-21-27.

[6] DOT (2024) "Office of the Chief Financial Officer and Assistant Secretary for Budget and Programs; U.S. Department of Transportation Learning Agenda: Fiscal Years 2024-2026," *Federal Register* (February 13, 2024), Docket No. DOT-OST-2024-0005, www.federalregister.gov/documents/2024/02/13/2024-02669/office-of-the-chief-financial-officer-and-assistant-secretary-for-budget-and-programs-us-department

[7] OMB (2024) "Circular A-11," Section 290.16.

[8] Regulations.gov (2024) "Learning Agenda: Fiscal Years 2024-2026," www.regulations.gov/document/DOT-OST-2024-0005-0001/comment.

[9] National Academies, Transportation Research Board (2024), "Annual Meeting 2024," www.nationalacademies.org/en/event/806_01-2024_trb-annual-meeting.

to understand their current priority questions and evidence building needs. A series of topic-specific listening sessions brought Operating Administration staff and leadership together to discuss cross-cutting evidence-building needs. At a Department-wide launch meeting held in February 2024, senior DOT leaders highlighted the importance of the Learning Agenda and surveyed over 130 attendees representing every Operating Administration on what they believe to be the Department's most critical learning needs.

OST-B's Office of Performance, Evaluation, and Enterprise Risk led the *Learning Agenda's* development.

To comment on DOT's learning priorities, goals, and additional evidence gaps or needs, please contact PEER@dot.gov.

GUIDE TO TOPIC AREAS, PRIORITY QUESTIONS, AND EVIDENCE-BUILDING ACTION PLANS

The Safety, Economic Strength and Global Competitiveness, Equity, Climate and Sustainability, and Transformation sections are structured around topic areas. These topic areas cover issues such as distracted driving, railroad grade crossings, and sustainable aviation fuel. In adherence with 5 U.S.C. § 312(a), the *Learning Agenda* contains these required components:

1. One or more policy-relevant priority questions

2. An action plan to answer the Department's policy-relevant questions by conducting evidence-building activities, to include:

    i. A list of data that the Department will collect, use, or acquire to build evidence for policymaking;

    ii. Methods and analytical approaches that the Department will take towards developing evidence to support policymaking;

    iii. Challenges that the Department faces in developing evidence to support policymaking, including statutory restrictions that prevent us from accessing relevant data

The topic areas also include background and context on the issue and explains its alignment with DOT's Strategic Goals and Strategic Objectives and other guiding documents.

Each topic area contains one or more specific and answerable priority questions that will have the biggest impact on our Department's functioning and performance. Answering these priority questions is critical to informing the DOT's work towards transforming our transportation system to make transportation safer, more reliable, more sustainable, and more affordable for travelers across our Nation.

Priority questions are a vehicle for agencies to ask, "what is it that the agency needs to do, what does it need to know to do it best, and what does it wish it knew?" They can ask large, strategic questions that if answered could help the Department deliver on its mission. These can be questions on how Departmental programs, policies, or regulations function. For example, in the Crash Causal Factors section the Department poses the question, "What are the key factors that contribute to crashes involving commercial motor vehicles (CMVs)?"

Priority questions can also ask critical operational questions. They can pose questions about how the Department manages human capital, grantmaking procedures, financial systems and tracking, or other internal processes.

[1] OMB (2024) Circular A-11, Section 290.7.

STRATEGIC GOAL: SAFETY

The Safety section offers a plan to build evidence to make the Nation's transportation system safer for all people, toward a future without transportation-related serious injuries and fatalities. It contains seven Safety topic areas. It revises and expands on the Pedestrian and Pedalcyclist Safety topic area and its priority questions from the Learning Agenda: FY 2022-2026. It also introduces six new Safety topic areas with priority questions nested underneath that cover a range of issues including Distracted Driving, Crash Causal Factors, Motor Carrier Vehicle Driver Detention Time, Railroad Grade Crossings, Aviation Surface Safety, and Preventing Unsafe Conditions and Near-Misses from Escalating to Serious Events. By addressing these priority questions, the DOT will generate evidence that fills crucial knowledge gaps on transportation safety and inform policy, operational, and regulatory decisions.

Pedestrian and Cyclist Safety

Priority Questions

- What methods have been shown to be effective for gathering and analyzing information on pedestrians and pedalcyclists' exposure to safety risks?
- Which infrastructure and technology solutions are effective in reducing pedestrian crashes and addressing disparities in pedestrian fatalities and injuries?
- In what ways do pedestrian and pedalcyclist crashes vary across the population? Which strategies are effective in advancing equity (or reducing inequity) in pedestrian and pedalcyclist crashes?
- To what extent might vehicle safety advancements mitigate incidents and injuries to pedestrians and pedalcyclists?

Background

Over the past decade there has been a significant increase in pedestrian fatalities. Between 2013 and 2022, pedestrian fatalities increased 57% from 4,779 to 7,522. The 2022 pedestrian fatality count was the highest since 1981 and pedestrian deaths accounted for 18 percent of all traffic fatalities. Early estimates for 2023 indicate a 2 percent decrease to 7,337 pedestrian fatalities, but they still remain alarmingly high.[10]

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[10] DOT, NHTSA, National Center for Statistics and Analysis (2024) "Traffic Safety Facts: 2022 Data - Pedestrians," DOT HS 813 590, https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813590; (2024) "Early Estimates of Motor Vehicle Traffic Fatalities and Fatality Rate By Sub-Categories in 2023," DOT HS 813 581, https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813581

In 2022, the most recent year for which non-estimates are available, there were 1,105 pedalcyclists killed in traffic crashes. Eighty-three percent of pedalcyclist fatalities in 2022 were in urban areas. In 2023, there were an estimated 1,149 pedalcyclist fatalities, which is a 4 percent increase from 2022.[11]

White pedestrians accounted for 40 percent of traffic fatalities, while all other race-ethnicity groups accounted for the remaining 60 percent in 2021. According to NHTSA's 2021 Fatality Analysis Reporting System (FARS) Final File data, Native Hawaiian or Other Pacific Islander and American Indian or Alaska Native pedalcyclists have lower fatality incidences than pedalcyclists in all other race-ethnicity groups.[12] White individuals accounted for 42 percent of nonoccupant traffic fatalities, Black or African American individuals accounted for 20 percent, and Hispanic or Latino individuals accounted for 19 percent.

The Department is committed to ensuring there are no disparities in opportunities to safely walk or bike in underserved communities compared to more affluent communities. Moreover, people with disabilities should be able to easily navigate walking and cycling facilities and fully experience the safety benefits of those facilities. By ensuring that such facilities are accessible, everyone will benefit from the potential safety improvements (such as protected intersections and quick-build curb bulb outs), and deployment of these facilities will be hastened by having the best accessible design practices.

Operating Administration(s)

National Highway Traffic Safety Administration (NHTSA)

Federal Highway Administration (FHWA)

Office of the Undersecretary for Policy (OST-P)

Office of the Assistant Secretary for Research and Technology (OST-R)

Alignment with DOT Strategic Goals and Strategic Objectives

- Strategic Goal: Safety
    - Strategic Objectives:
        - Safe Public
        - Safe Design

Alignment: Other Guiding Documents

- DOT FY 2025 Performance Plan / FY 2023 Performance Report [13]

- DOT National Roadway Safety Strategy and activities in the Progress Report [14]

- DOT Research, Development, and Technology Strategic Plan and Annual Modal Research Plans [15]

- DOT Equity Action Plan [16]

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[11] Ibid.

[12] DOT, NHTSA (2024) "Traffic Safety Facts: 2021 Data – Race and Ethnicity," DOT HS 813 572, https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813572.

[13] Performance Plan and Report at https://www.transportation.gov/budget

[14] NRSS at https://www.transportation.gov/nrss/2024-progress-report-national-roadway-safety-strategy

[15] RD&T Strategic Plan at https://www.transportation.gov/rdtstrategicplan and AMRPs at https://researchhub.bts.gov/amrp

[16] DOT Equity Action Plan at https://www.transportation.gov/priorities/equity/actionplan

Revisions to existing *Learning Agenda: FY 2022 – 2026* Priority Questions

The *DOT Learning Agenda: FY 2022 – 2026* contains a pedestrian and cyclist topic area. The *Learning Agenda: 2024-2026* revises the priority questions that fall under this topic area by replacing the term "cyclist" with the term "pedalcyclist." Prior to 2022, NHTSA's National Center for Statistics and Analysis defined pedalcyclists as "any person on a non-motorized other road vehicle propelled by pedaling. Examples include a bicycle, tricycle, unicycle, or pedal car," while motorized bicycles were classified as motorcycles and their operators and passengers were classified as motorists. Starting in 2022, NHTSA defines pedalcyclists as riders on bicycles and other cycles (tricycles and unicycles) powered by pedals and/or motors (i.e., motorized bicycles). At the same time, NHTSA expanded its definition of cyclists to include occupants of motorized cycles. Consequently, cyclist data captured in 2022 and beyond are not comparable to data reported prior to 2022.

In addition, FHWA and NHTSA refined the priority questions from the *Learning Agenda: FY 2022-2026* to ensure that they elicited the needed information.

What methods have been shown to be effective for gathering and analyzing information on pedestrians and pedalcyclists' exposure to safety risks?

Assessing risk requires data on the locations and volume of people walking and biking (i.e., exposure data). Exposure data requires volume counts and an inventory of the walking and/or pedalcycling network. NHTSA, FHWA, and OST-R have several ongoing and recently completed evidence-building projects that seek to improve exposure data collection including:

- *Influencing behavior*: NHTSA will continue to carry out evidence-building activities to understand how road user behavior could be influenced to limit risks to pedalcyclists and pedestrians. NHTSA collects and analyzes data related to who is at risk, where risks are highest, and what interventions are most likely to mitigate those risks.

- *Fill evidence gaps in pedestrian crash data*: To address the absence of recent and detailed pedestrian crash data in the United States, NHTSA worked with the Crash Injury Research and Engineering Network (CIREN) to develop modernized investigative protocols that address current research needs.[17] The investigative protocols focused on crash avoidance, infrastructure, crashworthiness, injury outcome, and behavior (of both driver and pedestrian). While developing the protocols, CIREN centers began investigating pedestrian crashes to assess the feasibility of collecting further data in these areas as well as refining the data collection. The modernized pedestrian protocols and definitions have since been implemented in the nationwide Crash Investigation Sampling System (CISS) data collection program.[18] NHTSA continues to explore ways to develop and collect valid pedestrian exposure data along with other modes, such as FHWA and FMCSA.

- *Land use and vehicle travel speeds*: Both historic and contemporary land use contribute to vehicle travel speeds, which contributes to pedestrian crash risk. Further, NHTSA recently published research on the effect of speed-reducing countermeasures on pedestrian and bicyclist safety, safety in numbers, and low-cost pedestrian safety zones.[19]

- *Advanced Imaging Techniques*: FHWA developed a vehicle-to-pedestrian test bed on the Turner-Fairbank Highway Research Center campus. This test bed includes thermal sensors that are being studied for their capabilities to detect and collect pedestrian, pedalcycle, and scooter data. As of summer 2024, FHWA has released a technical brief on the results of the thermal sensors and is preparing both a technical brief on the LiDAR sensors and a final report to summarize both sensors capabilities.[20]

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[17] CIREN at https://www.nhtsa.gov/research-data/crash-injury-research

[18] CISS at https://www.nhtsa.gov/crash-data-systems/crash-investigation-sampling-system

[19] S. Heiny, B. Lan, et al (2023) *Exploring the Impact of Select Speed-Reducing Countermeasures on Pedestrian and Bicyclist Safety*, (Washington, DC: DOT, NHTSA), DOT HS 813-446, https://rosap.ntl.bts.gov/view/dot/67641; S. Jackson, S. Miller, et al (2022), *Pedestrian/Bicyclist Safety in Numbers Program Evaluation* (2022) *Pedestrian/Bicyclist Safety in Numbers Program Evaluation*, (Washington, DC: DOT, NHTSA), DOT HS 813 342, https://rosap.ntl.bts.gov/view/dot/63314; Dunlap and Associates et al (2023) *Low-Cost Pedestrian Safety Zones: Countermeasure Selection Resource*, (Washington, DC: DOT, NHTSA), DOT HS 813 479, https://rosap.ntl.bts.gov/view/dot/67984.

[20] DOT, FHWA (2024) Enhancing Vulnerable Road User Detection and Volume Data Through the Use of Infrared Thermal Imaging Sensors, FHWA-HRT-24-135 https://highways.dot.gov/sites/fhwa.dot.gov/files/FHWA-HRT-24-135.pdf

- *Complete Streets AI Initiative (CSAI)*: FHWA, in collaboration with the Advanced Research Projects Agency – Infrastructure (ARPA-I) is conducting the "Complete Streets AI Initiative," a multi-phase effort funding small businesses to develop powerful new decision-support tool(s) for state, local and tribal transportation agencies that assists in the siting, design, and deployment of Complete Streets. Complete Streets are streets and networks that prioritize safety, comfort, and connectivity to destinations for all people who use them. CSAI aims to develop an interactive decision support tool for state and local transportation agencies where users can make queries or input boundary conditions that dynamically generate maps and other visualizations that reflect insights, answer questions, and help enable complete street improvements. CSAI encourages creative methods to develop national datasets using novel and scalable approaches to data science.[21]

Which infrastructure or technology solutions are effective in reducing pedestrian crashes and addressing disparities in pedestrian fatalities and injuries?

FHWA and OST-R has multiple ongoing research projects that seek to understand how road configurations and specific countermeasures may affect pedestrian and pedalcyclist safety risks.

- *Complete Streets Safety Analysis*: FHWA published the Complete Streets Safety Analysis Phase 1 report in March 2024. This report provides practitioners and other stakeholders with a resource that identifies and describes current capabilities, best practices, and future data and analysis needs for quantifying the safety-performance effects of multiple safety treatments that agencies implement simultaneously during the conversion of typical streets to Complete Streets. The recommendations include future research needs for data-driven safety analysis (DDSA) and future directions related to the potential use of other performance metrics that could provide additional insights into Complete Streets benefits, including broader public health benefits. The report includes three appendices that detail Complete Streets treatments, methods to develop crash modification factors (CMFs) for treatment combinations, and five case studies that illustrate the analysis methods and inform the content of the primer in Chapter 4.[22] FHWA held an external webinar on September 27, 2023, to provide an overview of the project and its resulting product.

- *Development of Pedestrian-Intersection Countermeasure Crash Modification Factors*: This project investigated the influence of intersection corner radius on pedestrian crashes, right-turn crashes, and right-turn vehicle speed. It was completed in FY 2022 with the publication of a technical brief and a final report. Since the corner radius can be unique to each corner at an intersection, this study assigned crashes to an intersection corner rather than to the entire intersection. This study's findings support the development of a crash modification factor for corner radius.[23] The findings from the operational study of right-turn speeds can be used to update the discussion contained in design manuals, especially with respect to designing intersections. For example, the National Association of City Transportation Officials recommends limiting right-turning speeds to 15 mph or less, and the equation provided in this study can be used to predict the geometric influence of a corner radius design on the anticipated speed of the right-turning movement to compare with the target criteria.

- *Assessment of Aesthetically Treated Crosswalks*: This study assesses the impact that aesthetically treated crosswalks have on road user recognition and behavior at crosswalks, looking specifically at rainbow crosswalks. As of spring 2024, the Phase 1 assessing impacts in a closed course environment was complete. FHWA is preparing a technical brief for publication. Phase 2 assesses impacts in the field. FHWA's research is currently underway.

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[21] DOT, "Complete Streets AI," https://its.dot.gov/CSAI/; (2024) "U.S. DOT Launches $15 Million Complete Streets Artificial Intelligence Initiative for Small Businesses," press release February 1, https://www.transportation.gov/briefing-room/us-dot-launches-15-million-complete-streets-artificial-intelligence-initiative-small.

[22] DOT, FHWA (2024) *Complete Streets—Safety Analysis*, FHWA-HRT-24-074, https://highways.dot.gov/research/publications/safety/FHWA-HRT-24-074.

[23] DOT, FHWA (2021) "Crash Modification Factor for Corner Radius, Right-Turn Speed, and Prediction of Pedestrian Crashes at Signalized Intersections," FHWA-HRT-21-106, https://www.fhwa.dot.gov/publications/research/safety/21106/index.cfm; (2022), FHWA-HRT-21-105, https://www.fhwa.dot.gov/publications/research/safety/21105/index.cfm.

- *Effective Selection of Crosswalk Design*: This study includes field research to help identify contexts in which high-visibility crosswalk designs may improve safety for pedestrians and will produce a guidebook for practitioners on crosswalk design policies. The research has been completed and the Crosswalk Marking Selection Guide was published in FY 2023. This guide synthesizes existing research and guidance on the safety, cost, and effectiveness of crosswalk marking patterns and makes recommendations for crosswalk marking selection and application.[24]

- *U.S. DOT Intersection Safety Challenge (ISC):* FHWA, in collaboration with the Advanced Research Projects Agency – Infrastructure (ARPA-I) is conducting an ongoing technology applications project, the "Intersection Safety Challenge," which seeks to transform intersection safety through the innovative application of emerging technologies including machine vision, sensor fusion, and real-time decision-making to identify and mitigate unsafe conditions involving vehicles and vulnerable road users.[25]

- *Countermeasures That Work:* In October 2023, NHTSA published the 11th edition of *Countermeasures That Work: A Highway Safety Countermeasure Guide for State Highway Safety Offices*, which included basic references to assist State Highway Offices in selecting effective, evidence-based behavioral strategies and countermeasures for a variety of traffic safety problem areas, including pedestrian and bicyclist safety. It describes pedestrian and bicyclist countermeasures and summarizes their use, effectiveness, costs, and implementation time. The report also provides references to the most important research.[26]

In what ways do pedestrian and pedalcyclist crashes vary across the population? Which strategies are effective in advancing equity (or reducing inequity) in pedestrian and pedalcyclist crashes?

NHTSA has continued foundational fact-finding activities to learn more about who is at risk, where risks are highest, and what interventions are most likely to mitigate those risks. For example, information found in the June 2024 publication and the September 2022 publication Evaluating Disparities in Traffic Fatalities by Race, Ethnicity, and Income has helped NHTSA better understand geographic elements of risk.[27]

FHWA's Exploring Potential Contributors to Racial and Socioeconomic Disparities in Pedestrian and Bicyclist Morbidity and Mortality project kicked off in November 2022 with an anticipated completion date of January 2025. This project assesses structural causes and potential strategies to address why underrepresented populations—particularly people experiencing homelessness and people who have been displaced—are overrepresented as victims in serious injury and fatal pedestrian and bicyclist crashes. FHWA's Office of Safety has successfully convened a subject matter expert panel to provide input, recommendations, and feedback throughout this project.[28] The research team has completed the first draft of the literature review and provided feedback. The case studies for this project have been selected and are being further explored and developed.[29]

Additionally, in FY 2023, FHWA established an Equity in Roadway Safety Working Group that includes representatives from multiple FHWA program offices and divisions. The Equity in Safety Working Group is developing resources to increase capacity in the areas of equity and transportation safety and is working to integrate equity into many of FHWA's products and programs. The Working Group delivers on Executive Order 14091 through the DOT Equity Action Plan by building the capacity of transportation professionals to equitably plan, design and build a roadway system that is safe, and feels safe, for all road users. The Working

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[24] DOT, FHWA (2023) *Crosswalk Marking Selection Guide*, FHWA-HEP-23-043, https://www.fhwa.dot.gov/environment/bicycle_pedestrian/resources/crosswalk_marking_selection_guide.pdf

[25] "Intersection Safety Challenge" at https://its.dot.gov/isc/.

[26] DOT, NHTSA (2023), *Countermeasures That Work: A Highway Safety Countermeasure Guide for State Highway Safety Offices*, 11th Edition, 2023, DOT HS 813 490, https://www.nhtsa.gov/book/countermeasures/countermeasures-that-work.

[27] DOT, NHTSA (2024), *Evaluating Disparities in Traffic Fatalities by Race, Ethnicity, and Income*, DOT HS 813 186, https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813188.

[28] The expert panel included technical expertise from a variety of positionalities, including non-profit, academic, small business, and advocacy group representatives. The panelists represent diversity in race, gender, and age.

[29] For about project, see FHWA's *Fast Lane Newsletter*, (Winter 2023), https://highways.dot.gov/sites/fhwa.dot.gov/files/FHWA-HRT-23-018.pdf.

Group advances continual learning and building the evidence base within FHWA, with our stakeholders, and through research, information sharing and training. It is working on three key tasks to build capacity:

- A research study which includes a scoping review and seven case studies entitled *Exploring Potential Contributors to Racial and Socioeconomic Disparities in Pedestrian and Bicyclist Morbidity and Mortality*
- A case study entitled *Promising Practices for Transportation Agencies to Address Road Safety Among People Experiencing Homelessness*[30]
- Equity in Roadway Safety webinar series[31]

New Priority Question in the Learning Agenda: FY 2024-2026

To what extent might vehicle safety advancements mitigate incidents and injuries to pedestrians and pedalcyclists?

Evidence-Building Activities

- *Pedestrian Automatic Emergency Braking:* In May 2023, NHTSA announced a Notice of Proposed Rulemaking that would require automatic emergency braking and pedestrian automatic emergency braking (PAEB) on passenger cars and light trucks.[32] Research for PAEB has focused on the development and validation of test procedures and evaluation criteria for the safety system. Test procedures were developed to address the most prevalent real-world pre-crash scenarios. Follow-on testing includes adding additional vehicles to the test and greater complexity to the scenarios to provide for a more robust test procedure.

- *Enhanced Vehicle Design:* NHTSA is working toward improved pedestrian protection in the event of vehicle-to-pedestrian crash through enhancements in the structural design of the vehicle. NHTSA issued a request for comments on the new pedestrian crashworthiness tests that measure how well a pedestrian target fares in a representative crash scenario. Research on the test procedures for that effort will continue as will testing of vehicle front end structure performance during a crash with pedalcyclists, shorter pedestrians, and other vulnerable road users.[33]

- *Vehicle-to-Everything:* FHWA is promoting vehicle-to-everything (V2X) technology with potential to save lives at scale faster for all road users, especially pedestrians and bicyclists. V2X technologies use wireless communications to link vehicles, mobile devices, and roadside infrastructure and exchange information on speed, location, heading, and presence of vulnerable road users (VRUs). In August 2024, DOT announced the release of *Saving Lives with Connectivity: A Plan to Accelerate V2X Deployment*.[34] This plan will guide the implementation of vehicle-to-everything technologies across the nation. It focuses on road safety, mobility, and efficiency through technology that enables vehicles and wireless devices to communicate with each other and with roadside infrastructure. So, if the road user is not paying attention, the technology can alert all road users and potentially prevent a crash. The associated Vehicle to Everything Accelerator Grants will be implemented over the next three years and provide scaled deployments in which the sites will measure benefits accrued from V2X Deployments on Safety.[35]

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[30] DOT, FHWA (2024), *Promising Practices for Transportation Agencies to Address Road Safety Among People Experiencing Homelessness*, https://highways.dot.gov/safety/zero-deaths/promising-practices-address-road-safety-among-people-experiencing-homelessness

[31] Webinars at https://highways.dot.gov/safety/zero-deaths/equity-roadway-safety-webinar-series.

[32] DOT, FMCSA (2023) "Federal Motor Vehicle Safety Standards: Automatic Emergency Braking Systems for Light Vehicles," *Federal Register* (June 13, 2023), Docket No. NHTSA-2023-0021, https://www.federalregister.gov/documents/2023/06/13/2023-11863/federal-motor-vehicle-safety-standards-automatic-emergency-braking-systems-for-light-vehicles

[33] DOT, NHTSA (2023) "New Car Assessment Program," *Federal Register* (May 26, 2023), Docket No. NHTSA-2023-0020, https://www.federalregister.gov/documents/2023/05/26/2023-11201/new-car-assessment-program

[34] DOT (2024) *Saving Lives with Connectivity: A Plan to Accelerate V2X Deployment*, https://ops.fhwa.dot.gov/program_areas/ops-cavet.htm

[35] DOT (2024) "USDOT Awards Nearly $60 Million in Advanced Vehicle Technology Grants to Arizona, Texas and Utah to Serve as National Models and Help Save Lives on Our Nation's Roadways," press release June 20, https://www.transportation.gov/briefing-room/usdot-awards-nearly-60-million-advanced-vehicle-technology-grants-arizona-texas-and

Tools

NHTSA uses several data sources to understand broader risks that impact pedestrian and cyclist safety. Test track testing provides information regarding vehicle performance capabilities and how advanced vehicle systems map to real-world crash scenarios. Injury modeling and test tools provide data on performance of advanced vehicle designs that have the potential to mitigate injuries in the event of a pedestrian or cyclist crash. In addition to the sources below, NHTSA also conducts observational studies and demonstration projects and collects data to answer specific research questions on pedestrian and bicyclist behavior.

Methods and analytical approaches

- *Pedestrian Automatic Emergency Braking*: In conjunction with the Notice of Proposed Rulemaking that would require automatic emergency braking and pedestrian automatic emergency braking on passenger cars and light trucks, NHTSA published a Preliminary Regulatory Impact Assessment. In this assessment, statistical and analytical methods were used to estimate the reduction in the number of crashes with pedestrians and the corresponding reductions in injuries and fatalities by equipping vehicles with pedestrian automatic emergency braking. Additionally, this assessment evaluated the incremental and total fleet cost in order to determine the cost-effectiveness of the rulemaking.[36]

- *Enhanced Vehicle Design*: NHTSA used biomechanical human injury modeling and pedestrian test tool devices to analyze how different modern vehicle front structures interact with real world pedestrians during collisions. NHTSA's resulting test procedures aim to measure how well a pedestrian fares in a representative crash scenario. The test results can then be used in consumer information programs or in regulation.

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[36] 89 FR 39688 (May 9, 2024), *Federal Register,* Docket No. NHTSA-2023-0021, https://www.regulations.gov/document/NHTSA-2023-0021-1065; DOT, NHTSA (2024), *Final Regulatory Impact Analysis (FRIA); Federal Motor Vehicle Safety Standard No. 127; Light Vehicle Automatic Emergency Braking (AEB); AEB Test Devices,* https://www.regulations.gov/document/NHTSA-2023-0021-1069

Distracted Driving

Priority Questions

Which vehicle designs promote and reinforce attentive driving and reduce driver distraction?

Background

Distracted driving is any activity that diverts attention from driving, including talking or texting on phones. Distracted driving remains a prominent safety problem on America's roadways. In 2021, crashes affected by distraction were estimated to kill at least 3,522 people and up to as many as 10,546 people.[37] As new technologies and interfaces are being introduced into the driving environment, it is important to perform research to understand the safety problem and evaluate the effectiveness of various technology-based countermeasures.

The National Highway Traffic Safety Administration (NHTSA) continues to research the role of technology in vehicles, both as a potential source of driver distraction and possible prevention opportunities. Evidence suggests that some vehicle designs can encourage secondary device use (e.g., picking up/looking at phones) and others require more glances off of the road to complete in-vehicle tasks than others (e.g., multiple sub menus in a touch screen to adjust climate controls vs. a simple knob).[38]

In 2010, NHTSA published the *Overview of the National Highway Traffic Safety Administration's Driver Distraction Program* detailing initiatives to address the complex problem of driver distraction and included information about planned and ongoing research at the time of publication. Many of the research projects it contains provided critical data for understanding the problem and informing NHTSA initiatives.[39] However, given the ways in which the distraction landscape has changed since publication of the overview document, some areas of research need updating. Associated initiatives and approaches to address distracted driving also warrant re-visiting.

Operating Administration

National Highway Traffic Safety Administration (NHTSA)

Alignment with DOT Strategic Plan

- Strategic Goal: Safety
    - Strategic Objectives:
        - Safe Public
        - Safe Design

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[37] Police reports, which are used to develop the data in the Fatality Analysis Reporting System to collect information on traffic fatalities, captured 3,522 (eight percent) distraction-affected fatalities in 2021, as reported in DOT, NHTSA, National Center for Statistics and Analysis (2024) "Traffic Safety Facts: 2022 Data – Pedestrians." A recent DOT study that incorporated naturalistic driving data (i.e. video of drivers) estimated a much larger number of distraction-affected crash fatalities: 10,546 (29 percent) of all traffic related deaths. Third-party studies also increasingly point to distraction as a significant cause of traffic deaths. See L. Blincoe, T. Miller et al. (2023) *The Economic and Societal Impact of Motor Vehicle Crashes*, 2019 (Revised), DOT HS 813 403, https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813403.pdf.

[38] Ibid.

[39] DOT, NHTSA (2010) *Overview of The National Highway Traffic Safety Administration's Driver Distraction Program*, DOT HS 811 299, https://www.nhtsa.gov/sites/nhtsa.gov/files/811299.pdf

Alignment: Other Guiding Documents

- National Roadway Safety Strategy and activities in the Progress Report
- DOT Research, Development, and Technology Strategic Plan for FY 2022-2026 and the Annual Modal Research Plans

Evidence Building Plan

Recently Completed Evidence-Building Activities

NHTSA's recent research programs and projects were primarily focused on:
- Understanding how in-vehicle interfaces can be designed to reduce driver workload
- Exploring approaches to minimize secondary device usage by drivers
- Assessing the effectiveness of driver monitoring systems (DMS) to detect and then mitigate driver distraction
- Understanding how advanced driver assistance systems (ADAS) may be impacting driver engagement

In October 2023, NHTSA published the 11th edition of *Countermeasures That Work: A Highway Safety Countermeasure Guide for State Highway Safety Offices*, which included basic references to assist State Highway Offices in selecting effective, evidence based behavioral strategies and countermeasures for a variety of traffic safety problem areas, including distracted driving. It describes distracted driving countermeasures and summarizes their use, effectiveness, costs, and implementation time. These countermeasures include graduated driving licensing passenger limits for young adults, cell phone laws, high-visibility cell phone enforcement, employer programs, and communications on outreach and distracted driving. The report also provides references to the most important research.[40]

During August 2024, NHTSA and OST hosted the Distraction Action Forum to solicit input from researchers and advocates in the Distracted Driving field.[41] These activities will be added to the NHTSA Research Day docket.[42]

Planned Evidence-Building Activities

NHTSA will continue to build knowledge through research on how vehicle design choices influence drivers to remain appropriately engaged in the driving task. NHTSA will continue to gather knowledge through systematic, empirical research. To supplement these learnings, NHTSA will also continue to work with both industry and modal partners to fully understand technology trends.

NHTSA will initiate a study "Secondary Device Usage, Needs Analysis, and Prevention Strategies" in 2024. The results of this study will be used to inform how vehicle design might meet driver needs while minimizing driver distraction. This study seeks to:

- Identify and characterize sources of driver distraction from secondary device use (e.g., a mobile phone);

- Identify and understand driver needs which are being met through secondary device use; and

- Understand how different types of secondary device use impact driver distraction.

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[40] DOT, NHTSA (2023), *Countermeasures That Work.*

[41] DOT (2024) "USDOT Tackles Distracted Driving, Gains New Safety Allies," press release September 4, https://www.transportation.gov/briefing-room/usdot-tackles-distracted-driving-gains-new-safety-allies.

[42] DOT, NHTSA (2024) "NHTSA Safety Research Portfolio Meeting: Fall 2024," *Federal Register* (August 23, 2024), Docket No. NHTSA-2024-0040, https://www.federalregister.gov/documents/2024/08/23/2024-18994/nhtsa-safety-research-portfolio-public-meeting-fall-2024

Known or Potential Data
All NHTSA databases (e.g., Fatality Analysis Reporting System) and annual observational studies (e.g., NOPUS), as well as those from other sources, will be used to estimate impacts on reducing driver distraction.[43]

Methods and Analytical Approaches
These empirical data will be supplemented with data from field data collection/naturalistic data collection and information from industry partners. NHTSA will leverage the broader stakeholder community and their diverse perspectives. As part of the research process, NHTSA will systematically research why and when drivers choose to engage in distracting behaviors. In a controlled setting, countermeasures – including vehicle interface design strategies – will be evaluated to understand their effectiveness. Broadly, NHTSA will use specific qualitative and quantitative implementation, process, and outcome measures to assess research progress, as well as adoption, implementation, and impact evaluation of identified countermeasures.

Anticipated Challenges and Mitigation Strategies
Combating distracted driving involves understanding why drivers engage in distracting tasks, identifying when a driver is distracted, and finding effective countermeasures that could reduce or prevent this risky behavior. Identifying a direct metric between countermeasure implementation and associated causal crash and fatality reductions is challenging due to the many confounding factors. To the extent possible, researchers will seek to address potential confounds through the design of the research methods.

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[43] FARS at https://www.nhtsa.gov/research-data/fatality-analysis-reporting-system-fars

Crash Causal Factors

Priority Questions

What are the key factors that contribute to crashes involving commercial motor vehicles (CMVs)?

Background

FMCSA created the Crash Data Analytics Division (MC-RRC) to lead the Crash Causal Factors Program (CCFP) and advance analysis into factors that contribute to Commercial Motor Vehicle (CMV) crashes. Through a series of robust studies, the CCFP pursues a nuanced understanding of crashes involving CMVs so that policymakers, law enforcement agencies, regulators, and other interested parties can implement effective crash prevention strategies and programs.

FMCSA defines a CMV as any motor vehicle used on a highway in interstate commerce to transport property or passengers when the vehicle:

- Has a gross vehicle weight rating (GVWR) of 10,001 pounds or more;
- Is single or combination of vehicles with a gross vehicle weight rating (GVWR) of 26,001 pounds or more;
- Is designed or used to transport more than 8 passengers (including the driver) for compensation, or more than 15 passengers if not receiving compensation for the transportation; or
- Is any size and transports hazardous materials that require federal placarding.[44]

The CCFP is a detailed crash data collection and analysis effort intended to:

- Identify the key factors that contribute to crashes involving CMVs,
- Inform countermeasures to prevent these crashes, and,
- Establish a foundation for continued data collection, sharing, and analysis.

Despite several decades of positive progress, the last few years have seen a concerning rise in fatal crashes in the United States, with fatal crashes involving CMVs increasing approximately 20 percent from 2020 to 2022 (an increase from 4,574 in 2020 to 5,476 in 2022). The CCFP is part of DOT's and FMCSA's heightened effort to reverse this trend and pursue a long-term goal of zero roadway fatalities.

The CCFP expands on the original Large Truck Crash Causation Study (LTCCS)[45] that investigated nearly 1,000 injury and fatal crashes involving large trucks from 2001 to 2003.[46] However, an increase in fatal crashes involving CMVs in the last few years, along with changes in technology, vehicle safety, behavior, and roadway design, has created the need for a new study for the department to better understand the factors contributing to this increase in crashes. The CCFP takes these changes and the growth of the CMV industry into account as it pursues an updated understanding of the causal factors contributing to today's crashes.

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[44] FMCSA (2024) "FAQ: What is the difference between a commercial motor vehicle (CMV) and a non-CMV?," https://www.fmcsa.dot.gov/faq/what-difference-between-commercial-motor-vehicle-cmv-and-non-cmv

[45] LTCCS at https://www.fmcsa.dot.gov/research-and-analysis/research/large-truck-crash-causation-study.

[46] The data from the study, along with the original report to Congress, data tables, and other study information, may be downloaded in several formats from https://ai.fmcsa.dot.gov/CarrierResearchResults/

The CCFP's work is rooted in two pieces of legislation. First, the Consolidated Appropriations Act of 2021 appropriated $30 million to FMCSA to "carry out [a] study of the cause[s] of large truck crashes" to include the Phase 1 Heavy-Duty Struck Study. Second, the Bipartisan Infrastructure Law contains requirements for a larger study under Section 23006: Study of Commercial Motor Vehicle Crash Causation. It requires the Secretary to "carry out a comprehensive study to determine the causes of, and contributing factors to, crashes that involve a commercial motor vehicle." It defines the scope of the study to include all CMVs as covered by 49 U.S.C. §31132. FMCSA met with Congress to reconcile the differences between the two laws to create the Crash Causal Factors Program.

Operating Administration

Federal Motor Carrier Safety Administration (FMCSA)
Bureau of Transportation Statistics (BTS)
Volpe National Transportation Systems Center
National Highway Traffic Safety Administration (NHTSA)

Alignment with DOT Strategic Plan

- Strategic Goal: Safety
  - Strategic Objectives:
    - Safe Public
    - Safe Workers
    - Safe Systems

Alignment: Other Guiding Documents

- National Roadway Safety Strategy and activities in the Progress Report

- DOT Research, Development, and Technology Strategic Plan for FY 2022-2026 and the Annual Modal Research Plans

Evidence Building Plan

Recently Completed Evidence–Building Activities

The CCFP's multi-phase approach will target unique vehicle types and/or crash severities for each causal factors study. The first phase of CCFP is the Heavy-Duty Truck Study (HDTS). The HDTS focuses on fatal crashes involving Class 7/8 large trucks, which have a gross vehicle weight rating (GVWR) of 26,001 pounds or more. This includes truck-tractor semi-trailers, furniture trucks, garbage trucks, and cement trucks. This phase will leverage existing State and local jurisdiction crash data collection processes to streamline data collection efforts. Future phases will continue to identify existing resources, leveraging these efforts to the extent possible. In addition to producing datasets and analytical reports, the CCFP will establish a foundation for continued data collection and analysis that FMCSA and States can routinely use to optimize their CMV safety activities.

The HDTS will allow FMCSA to establish a strong, repeatable foundation for future phases of the CCFP. To set this foundation, a thorough preparatory phase focuses on understanding existing data collection efforts and creating a technical framework for collecting data from a diverse set of forms and processes. In CY 2024, FMCSA is collecting necessary information from States and local jurisdictions. The information collected will inform FMCSA on what vital study data is already being collected by the States. This will allow FMCSA to partner with States and local jurisdictions to leverage data currently being collected and reduce duplication of efforts.

In the definition phase, FMCSA identified data gaps that the HDTS and the larger CCFP could fill. Next, FMCSA did a high-level concept analysis of alternatives to identify and compare all the potential components to carry out the HDTS. Through that effort, FMCSA identified the best concepts to explore further with a focus on estimated costs, sustainability/repeatability, and stakeholder needs. FMCSA worked to deconstruct the high-level HDTS requirements, identified key study components and looked at seven alternatives that would allow FMCSA to meet the HDTS goals.

Current activities and milestones in CY 2024:

- FMCSA is collecting information from States and local jurisdictions through a series of web-based surveys from a nationally representative sample of State and local jurisdictions. This will allow FMCSA to understand what vital study data is being collected by the States, how that data is stored, and what challenges or restrictions States and local jurisdictions have in participating in CCFP. Information collected will inform the Phase 1 sample design, data collection forms, and IT solution.

- FMCSA is identifying crash data elements and attributes that States currently collect and gathering them into a common format to better understand what is currently captured. Once all State crash data is cataloged together, it will be applied to the CCFP Phase 1 research questions. This will allow the CCFP project team to identify where data gaps exist, and methods for collecting data to address those questions. Data mapped includes all information from State police crash reports (PCR), post-crash investigation or reconstruction forms, post-crash inspections and any CMV supplemental forms.

- FMCSA anticipates awarding an interagency agreement (IAA) with the Bureau of Transportation Statistics (BTS) by Q4 2024 for Confidential Information Protection and Statistical Efficiency Act (CIPSEA) data collection.

- FMCSA CCFP staff are working closely with FMCSA's Chief Technology Officer staff to build the business requirements for the CCFP IT solution. A vendor is in place as of September 2024 and the CCFP IT Solution will be delivered in Q2 2025.

- The Heavy-Duty Truck Study sample design team identified in-scope States in summer 2024. This is allowing the CCFP team to begin data sharing agreements and Memoranda of Understanding with key partners.

Planned Evidence-Building Activities

In FY 2024- 2026, FMCSA will finalize data collection agreements, gathering information for study data collection, and onboarding and training the data collection team.

Known or Potential Data

FMCSA plans to leverage existing data collection efforts to the degree possible. This will include creating partnerships with States and local jurisdictions to leverage data from police crash reports, post-crash inspections, post-crash investigations and crash reconstructions. Supplemental data forms will be developed for on-scene data collection gaps, which may vary by State/jurisdiction. Additionally, FMCSA will partner with BTS to collect confidential data under the Confidential Information Protection and Statistical Efficiency Act and conduct follow-up interviews of the driver, carrier, and witnesses.

Tools

FMCSA will have a unique IT solution for CCFP data collection, transfer, and storage needs. This will include a data lake to house data from the various sources of collection, and an interface for State CMV data analysts to enter supplemental data needs within each State and perform data quality checks. The exact IT solution deliverables will be finalized Q4 CY 2024.

Methods and Analytical Approaches

In addition to partnering with States and local jurisdictions, FMCSA is partnering with many Operating Administrations (OAs) on this effort. This includes:

- Volpe Center: FMCSA has an active inter-agency agreement with Volpe to support CCFP. FMCSA has partnered with Volpe to create a nationally representative sample design for Phase 1 of CCFP. This will allow FMCSA to identify sampling sites required to develop a nationally representative sample design. This plan is anticipated to be completed by Q4 CY 2024 and will be part of Phase 1 data collection. Key task areas include:

  - Survey development and administration
  - Sample design and analysis planning
  - Data collection requirements
  - Project planning, management, and communications
  - Crash Causal Factor data analysis

- FMCSA is planning to award an inter-agency agreement to the Bureau of Transportation Statistics (BTS) in Q4 2024 to allow FMCSA to leverage CIPSEA (Confidential Information Protection and Statistical Efficiency Act) protections in supplemental CCFP data collection.

- FMCSA is collaborating with NHTSA to train FMCSA staff on the Fatality Analysis Reporting System (FARS) reporting standards to lay the foundation for State CMV Data Analyst training.

Anticipated Challenges and Mitigation Strategies

FMCSA is identifying potential challenges and mitigation strategies for the CCFP. The CCFP project team has an active risk registry that is updated monthly to reflect changes in current challenges and potential challenges that may arise given current situations. Currently, the Heavy-Duty Truck Study data collection is anticipated to kick off in January 2026 with a pilot phase, and full data collection for all participating States and jurisdictions will begin in Q2 2026.

Currently, the largest challenges anticipated include:

- CCFP IT Solution: A complete solution for the IT needs of CCFP (e.g., data lake, user interface and associated documentation) is required by September 2025 to allow for adequate timing. This requires a vendor to be onboarded no later than October 2024.

- State and Local Jurisdiction Participation: CCFP's success is built on active partnerships and collaboration with State and local agencies who are actively collecting data at CMV crash scenes. FMCSA is currently determining the best avenue to secure agreements with the States for data sharing.

FMCSA is mitigating these challenges through a risk registry. The CCFP project team meets monthly to review all current risks and associated mitigation strategies. All risks are updated based on the current timeline, and mitigation strategies are changed if necessary.

Commercial Motor Vehicle Driver Detention Time

Priority Questions

What is the frequency and severity of detention time experienced by commercial motor vehicle (CMV) drivers and its impact on CMV safety and operations?

Background

"Detention time" refers to the extra time CMV operators wait at shipping and receiving facilities due to delays associated with the loading and unloading of cargo. Drivers are often not paid for this time. Although there is currently no standard definition of detention time, the CMV industry, the U.S. Government, and academic researchers in the U.S. have typically used dwell time—the total amount of time spent at a facility—exceeding two hours to define when detention time occurs.

Detention time in the CMV industry is a longstanding issue and is consistently ranked as one of the top problems CMV operators face.[47] In February 2011, the U.S. Government Accountability Office (GAO) issued a report indicating that approximately two thirds of drivers had experienced detention time in the past month.[48] In 2018, DOT's Office of Inspector General (OIG) estimated that detention time is associated with reduced driver annual earnings of $1.1 to $1.3 billion for certain sectors of the trucking industry.[49] Belella et al. reported that eliminating inefficiencies in loading and unloading could gain U.S. carriers $3.1 billion annually, with society as a whole gaining $6.6 billion annually.[50]

In addition, detention time affects CMV drivers' ability to meet hours of service requirements by reducing their available driving time.[51] "Hours of service" refers to the maximum amount of time drivers are permitted to be on duty including driving time, and the regulation specifies the number and length of rest periods, to help ensure that drivers stay awake and alert. In general, all carriers and drivers operating CMVs must comply with Hours of Service regulations found in 49 CFR 395. Drivers who experience detention time may be more inclined to drive faster to reach their destinations within the hours-of-service limits or to operate beyond hours of service limits and improperly log their driving and duty time to make deliveries on time. The Office of the Inspector General's 2018 study concluded that a 15-minute increase in average dwell time increases the average expected crash rate by 6.2%.[52] This translates to each one-minute reduction in average detention time nationwide potentially preventing roughly 400 crashes per year. A reduction in driver detention time would also reduce the time trucks spend idling, leading to a positive impact on greenhouse gas emissions.

The goal of FMCSA's Impact of Driver Detention Time on Safety and Operations study is to better understand any relationship between detention time and CMV safety. FMCSA also hopes that collecting and analyzing data on detention time can contribute to a more complete understanding of these issues and facilitate private sector decisions that lead to reductions in detention time and improvements in safety and supply chain efficiency.

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[47] DAT Freight and Analytics (2016) "63 Percent of Drivers are Detained for More Than 3 Hours Per Stop," press release July 14, https://www.dat.com/company/news-events/news-releases/63-percent-of-drivers-are-detained-for-more-than-3-hours-per-stop-dat-solutions.

[48] U.S. GAO (2011) *Commercial Motor Carriers: More Could be Done to Determine Impacts of Excessive Loading and Unloading Wait Times on Hours of Service Violations*, GAO-11-198, https://www.gao.gov/products/gao-11-198.

[49] DOT, OIG (2018) *Estimates Show Commercial Driver Detention Increases Crash Risks and Costs, but Current Data Limit Further Analysis*, ST2018019, https://www.oig.dot.gov/sites/default/files/FMCSA%20Driver%20Detention%20Final%20Report.pdf.

[50] DOT, FMCSA (2009) "Motor Carrier Efficiency Study: Part I," FMCSA-RRT-09-015, https://rosap.ntl.bts.gov/view/dot/93

[51] GAO; DOT, OIG.

[52] DOT, OIG.

Operating Administration

Federal Motor Carrier Safety Administration (FMCSA)

Alignment with DOT Strategic Plan

- Strategic Goal: Safety
  - Strategic Objectives:
    - Safe Public
    - Safe Design
- Strategic Goal: Economic Strength and Global Competitiveness
  - Strategic Objective: System Reliability and Connectivity
- Strategic Goal: Transformation

Alignment: Other Guiding Documents

- National Roadway Safety Strategy and activities in the Progress Report
- DOT Research, Development, and Technology Strategic Plan for FY 2022-2026 and the Annual Modal Research Plans
- DOT Climate Action Plan [53]
- U.S. National Blueprint for Transportation Decarbonization [54]

Evidence Building Plan

Recently Completed Evidence-Building Activities

The project team has completed qualitative interviews with nine representative carriers and begun pilot data collection to refine the proposed database structure and test data communication. The project team is using this information to inform the study design and related data collection instruments, which are nearly complete. The project team is continuing carrier study recruitment through outreach at industry events and trade shows as well as through the project website. The project team also collected quantitative data from a small number of motor carriers in 2024.

Planned Evidence-Building Activities

FMCSA plans to recruit carriers for its conduct quantitative data collection.

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[53] DOT (2021) *Climate Action Plan: Revitalizing Efforts to Bolster Adaption and Increase Resilience*, https://www.transportation.gov/sites/dot.gov/files/2021-10/Climate_Action_Plan.pdf.

[54] DOE, DOT, EPA, HUD (2024) *U.S. National Blueprint for Transportation Decarbonization*, https://www.energy.gov/sites/default/files/2023-01/the-us-national-blueprint-for-transportation-decarbonization.pdf.

Known or Potential Data

The research study plans to collect 12 months of quantitative safety and operational data from up to 80 commercial motor carriers and 2,500 of their CMV drivers. Data collected will include electronic logging device (ELD) records, GPS location information, telematics data, pickup/delivery details, information on tasks completed while at shipping and receiving facilities, crashes, violations, and carrier demographics. In addition, the project team interviewed nine motor carriers of various types to gather qualitative information detention time and the motor carrier's operations, and information on methods used to minimize negative impacts.

Methods and Analytical Approaches

Data will be collected and analyzed from a wide variety of carriers (long-haul/short-haul, private/for-hire, hourly-/mileage-based payments, open/specific delivery times, truckload/less-than-truckload, port servicing, owner-operators, etc.), since different carrier types can be affected differently by detention time.

Anticipated Challenges and Mitigation Strategies

Success of the study relies heavily on recruiting a sufficient number of carriers in order to generate the data needed to answer the research questions. Participation in FMCSA studies by those regulated by FMCSA can be a deterrent as some carriers have concerns that their data could be used against them.

To address this, data gathered in both the qualitative and quantitative tasks will be anonymized. During recruitment, motor carriers will be assured that none of their data or data from, or about, their drivers will ever be made public or known to FMCSA.

Photo Credit: Getty Images

Railroad Grade Crossings

Priority Questions

Which Federal Railroad Administration (FRA) initiatives have the largest impact on reducing the frequency and severity of highway-rail grade crossing incidents?

- Which FRA existing or proposed policies, programs, and interventions effectively persuade the stakeholders of the highest-risk crossings to implement improvements and other initiatives to reduce grade crossing incidents?
- What technological solutions effectively and efficiently reduce grade crossing incidents?
- To what extent do FRA's grant investments contribute to the reduction of incidents?
- To what extent does FRA's partnership with Operation Lifesaver and other stakeholders inform the public about grade crossing safety?

Background

A highway-rail grade crossing is statutorily defined as any location where (1) a public highway, road, or street, or a private roadway, including associated sidewalks and pathways, crosses one or more railroad tracks either at grade or grade-separated; or (2) a pathway explicitly authorized by a public authority or a railroad carrier that is dedicated for the use of nonvehicular traffic, including pedestrians, bicyclists, and others, that is not associated with a public highway, road, or street, or a private roadway, and crosses one or more railroad tracks either at grade or grade-separated.[55]

Highway-rail grade crossing incidents and trespassing account for the majority of rail-related deaths each year. A highway-rail incident is any collision between rail and highway users at a public or private crossing. Answering this question will enable FRA and its stakeholders to focus efforts on the highest-risk crossings and the appropriate infrastructure improvements or other efforts that will reduce the number of incidents across the Nation and save lives. In FY 2022, there were 274 crossing fatalities and 812 crossing injuries across the Nation. These statistics indicate a significant area that requires efforts to educate the public, increase enforcement, and improve infrastructure around grade crossings.

FRA's Office of Railroad Safety (RRS) and external stakeholders will use the information to inform safety improvements and other actions at the highest-risk crossings. FRA's Office of Railroad Development (RRD) will use the information to ensure applicants propose and implement the most effective grade crossing improvements. FRA's Office of Research, Data, and Innovation (RDI) will use the information to develop and test technologies and tools that may improve grade crossing safety.

Operating Administration

Federal Railroad Administration (FRA)

Alignment with DOT Strategic Plan

- Strategic Goal: Safety
  - Strategic Objective: Safe Public

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[55] Public Law 110–432

Alignment: Other Guiding Documents

- National Roadway Safety Strategy and activities in the Progress Report
- DOT Research, Development, and Technology Strategic Plan for FY 2022-2026 and the Annual Modal Research Plans
- Saving Lives with Connectivity: A Plan to Accelerate V2X Deployment[56]

Evidence Building Plan

Recently Completed Evidence-Building Activities

FRA's Office of Research, Development, and Technology (RD&T) is developing a Grade Crossing Toolkit. The Toolkit will serve as a repository of research results in an easy-to-use format and will contain guides, noteworthy practices, and results of implementing innovative safety measures at grade crossings. States and other stakeholders can use the Toolkit to develop state and local action plans and applications for federal funding.

The Cellular-Vehicle-to-Everything (C-V2X) Train Arrival and Departure Information Assessment focuses on assessing the feasibility of implementing Cellular-Vehicle-to-Everything technology at grade crossings. It runs from August 2023 to August 2025. This technology aims to enhance the safety of connected vehicles and pedestrians at these crossings. Vehicle-to-everything (V2X) technology enables vehicles to communicate with each other, with other road users such as pedestrians, cyclists, individuals with disabilities, and other vulnerable road users, and with roadside infrastructure, through wirelessly exchanged messages. The project will include a comprehensive assessment to identify future research directions and potential prototype developments for improving grade crossing safety. Researchers will work in coordination with partners and academic institutions to conceptualize, develop, and evaluate a Rail Crossing Violation Warning (RCVW) system. This system will be designed to augment existing active grade crossing warnings.

FRA published a process evaluation of education activities provided by Operation Lifesaver, Inc. (OLI) in September 2024. The evaluation documents how Operation Lifesaver, Inc, a non-profit organization and nationally recognized leader of rail safety education, communicates safety materials and products to stakeholders and to what extent it is fulfilling its obligations under its grant. FRA is using its findings to identify potential process improvements that will support a sustainable, successful program. This evaluation responds to the commitment FRA made in the DOT FY 2024 Evaluation Plan.[57]

The Grade Crossing Light Detection and Ranging (LiDAR) project will continue to scan grade crossings nationwide and develop the infrastructure to store and provide grade crossing scans accessible to the public. LiDAR and optical technologies are used to scan public crossings and provide 3D point cloud images of the crossing profiles that can be used to identify various attributes like number of tracks, sight distances, road/track angles, and the type of safety technologies used. Various platforms are used to accomplish this task, including LiDAR mounted on the FRA Autonomous Track Inspection Program's geometry cars, hi-rail vehicles, and unmanned aerial vehicles (UAVs) or drones. Improved communication and information availability will help reduce incidents and accidents at grade crossings by assisting States and local entities to assess issues at grade crossings and identify infrastructure improvements needed to address those issues. For example, LiDAR scanning can help identify humped crossings and guide grade crossing maintenance and design activities to reduce the crossing profile and be compliant with national standards. This will decrease the incidents of low-clearance vehicles getting stuck and reduce potential collision with trains.

Motor vehicle traffic at grade crossings is currently being estimated by the Connected Vehicle Data project. Connected vehicle data at grade crossings has the potential to improve the overall safety and access to information at crossings nationwide.

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[56] DOT (2024) *Saving Lives with Connectivity: A Plan to Accelerate V2X Deployment*, https://www.its.dot.gov/research_areas/emerging_tech/pdf/Accelerate_ V2X_Deployment_final.pdf.

[57] G. Melnik, H. Safar et al (2024) *Operation Lifesaver Inc. Process Evaluation*, (Washington, DC: DOT, FRA), DOT/FRA/ORD-24/34, https://railroads.dot. gov/elibrary/operation-lifesaver-inc-process-evaluation.

Planned Evidence-Building Activities

FRA is currently procuring services for the Grade Crossing Grant Benefits evaluation included within DOT's FY 2024 Evaluation Plan. The contract for the evaluation services is expected to begin in FY 2025.

Known or Potential Data

- Grade crossing safety data
- Grade crossing design information
- Incident root causes
- FRA-funded grade crossing improvements
- Stakeholder activities
- Research and development for grade crossing technologies

Tools

FRA's safety data website will be used to obtain grade crossing safety data.[58] DOT's DataHub and FRA's public website will be used to publish evaluation data and results. For grant data, FRA is working to make this information, which is currently only in a PDF format, more accessible for evaluation purposes.

Methods and Analytical Approaches

- Descriptive studies and formative evaluations
- Foundational fact-finding
- Process and implementation evaluations
- Data analysis
- Cost-benefit analysis
- Outcome and impact evaluations

Anticipated Challenges and Mitigation Strategies

- Accessibility and reliability of data
- Identifying causal impacts (there are many factors that play a role in grade crossing incidents)
- Resource availability (FRA staff, funding, stakeholder engagement)
- FRA does not have direct authority to mandate grade crossing infrastructure improvements
- Improvements to grade crossings may take years before benefits are realized
- In many situations the Federal and State laws and regulations are inconsistent. These inconsistencies can complicate the implementation and enforcement of safety measures, potentially impacting the overall safety at grade crossings.

FRA can further efforts to improve the data accuracy within the Grade Crossing inventory. FRA can also ensure targeted stakeholder community engagement by hiring additional inspectors, increasing enforcement activities, and involving stakeholders in the design and construction of grade crossings to maximize safety and minimize potential unsafe consequences.

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[58] FRA Safety Data & Reporting at https://railroads.dot.gov/safety-data.

Aviation Surface Safety

Priority Questions

How can National Airspace System (NAS) Airports be prioritized for the deployment of Approach Runway Verification (ARV) software to increase situational awareness of surface operations?

Background

Reducing surface safety risk remains a top priority for the FAA. The Surface Safety Risk Index measures the overall safety performance of the national airspace in the surface environment. While the FY 2023 Surface Safety Risk Index remained well below "not to exceed" targets for both the commercial and non-commercial operations, an increase in runway incursions and other surface safety incidents from late 2022 and into early 2023 led the FAA to issue a Safety Call to Action in February 2023.[59] The Safety Call to Action resulted in additional outreach from FAA's Air Traffic Organization leadership to the aviation industry, union partners, and other aviation experts. It also resulted in the development of collaborative action plans addressing runway incursions. The Safety Call to Action prompted the addition of focused data reviews to raise awareness for the FAA's existing runway safety programs and campaigns, including convening an independent Safety Review Team (SRT), conducting a National Transportation Safety Board Roundtable, and sponsoring a Surface Safety Industry Day.

Based on the Safety Review Team recommendations released in November 2023, the FAA took steps toward addressing process integrity. One of the recommendations is the creation of a program to facilitate a proactive, predictive approach to risk management. Creating such a program requires time and significant resource investments to evolve processes and the safety culture. As of FY 2024, the FAA is acquiring future technologies as part of this proactive, predictive approach to runway safety risk management. The Approach Runway Verification (ARV) software is part of this program.

By rigorously confirming the accuracy of approach procedures, Approach Runway Verification (ARV) software can be used to reduce the risk of errors and enhance pilot guidance during crucial landing phases. It alerts controllers if an aircraft is aligned with any surface other than the assigned runway, thereby helping controllers to intervene and prevent a wrong surface landing. Furthermore, Approach Runway Verification's proactive methodology ensures that approach procedures stay updated with technological advancements, aligning with FAA's commitment to ongoing safety improvement.

As the FAA evolves into Risk-Based Safety Management (RBSM), it is able to focus on a systemic view of the runway environment that leads to the identification of risk before it becomes an event. Risk-Based Safety Management manages aviation safety systemically through a continuous and comprehensive application of investigative, reporting, analysis, mitigation, measurement and feedback endeavors through both dynamic and static processes. It enables predictive capabilities through the early recognition of risk data patterns, which drives preventive risk mitigation.

Definitions

- Surface incident: Unauthorized or unapproved movement within the designated movement area (excluding runway incursions) or an occurrence in that same area associated with the operation of an aircraft that affects or could affect the safety of flight.
- Runway excursions: A veer-off, undershoot, or overrun off the runway surface.
- Runway incursions: Any occurrence at an airport involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and takeoff of aircraft.
- Operations: Takeoffs and landings.

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[59] Surface Safety Risk Index at https://www.faa.gov/newsroom/runway-safety-fact-sheet; FAA Safety Call to Action at https://www.faa.gov/aviation-safety-call-to-action.

- Wrong surface operations: A wrong surface operation occurs when an aircraft lands or departs, or attempts to land or depart, on a surface other than the cleared runway. It also occurs when an aircraft lands or attempts to land at the wrong airport.
- Surface environment: Designated airport movement area controlled by the FAA, including runways and taxiways.

Operating Administration

Federal Aviation Administration (FAA)

Alignment with DOT Strategic Plan

- Strategic Goal: Safety
  - Strategic Objective: Safe Systems

Alignment: Other Guiding Documents

- National Runway Safety Plan 2024-2026 (NRSP)[60]
- DOT Research, Development, and Technology Strategic Plan for FY 2022-2026 and the Annual Modal Research Plans

Evidence Building Plan

Recently Completed Evidence-Building Activities

The deployment of the Approach Runway Verification software began in FY 2024 at key locations and will continue through FY 2026.

Planned Evidence-Building Activities

Prioritization of airport locations that will receive Approach Runway Verification will be completed by conducting an analysis for each potential airport. This would include the review of safety event data and safety risk analysis associated with wrong surface operations at National Airspace System terminal facilities. Benefits that will be considered include increased controller awareness and efficiency savings resulting from a reduction in flight interruptions. Additional details on the methodology are under development and will be included in future updates to the Learning Agenda.

Known or Potential Data

The FAA Runway Safety Tracking System collects and supports analysis of surface safety event data and Runway Safety Action Team action items. The Runway Safety Action Team (RSAT) website provides a visual depiction of all events pinned on a facility map to support prioritization of surface risk mitigation activity.[61] Runway excursion data is supplemented by the Office of Accident Investigation and Prevention's Aviation System Information Analysis and Sharing database. Once received, preliminary incident reports may take up to 90 days to complete. Data may also be found in the Aviation System Information Analysis and Sharing (ASIAS) databases.[62]

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[60] DOT, FAA (2024) *National Runway Safety Plan 2024-2026*, https://www.faa.gov/airports/runway_safety/plans/national-runway-safety-plan.pdf

[61] RSAT at https://www.faa.gov/airports/runway_safety.

[62] ASIAS database at https://www.asias.faa.gov.

Tools

The FAA is leveraging existing tools and potentially developing new ones in order to assess which airports would most benefit from the deployment of surface situational awareness technology solutions for proactive risk management. The Comprehensive Electronic Data Analysis and Reporting (CEDAR), the Runway Safety Tracking System, and the Runway Safety Action Team webtool will all be leveraged to review event data, assess safety risk deviation from baseline, and build the evidence to define prioritization of sites to receive Approach Runway Verification in a waterfall fashion.

Methods and Analytical Approaches

All surface safety events, with a focus on wrong surface landing operations, will be analyzed to identify which terminal locations have the highest number of events, with the highest safety risk, and therefore will best benefit from Approach Runway Verification. To prioritize the airport locations that will benefit from surface safety awareness technologies, the FAA will consider a methodology that aligns with top surface safety risks versus isolated occurrences. The FAA is exploring if the use of machine learning algorithms, including Long Short-Term Memory for anomaly detection, will be beneficial in this context.

Anticipated Challenges and Mitigation Strategies

The complexity of air traffic operations introduces many factors that occur simultaneously and result in combined outcomes. This presents a challenge in accurately identifying and isolating the effects of specific causal factors.

Following FAA's Safety Management System (SMS), all surface safety risks (such as pilot deviations, operational incidents, vehicle driver and pedestrian incidents, airport construction projects, changes to arrival procedures, etc.) will be looked at, in conjunction with wrong surface operations, to determine an overall risk profile for a facility. These broader perspectives will play an important role in the prioritization of sites on the Approach Runway Verification implementation schedule.

Preventing Unsafe Conditions and Near-Misses from Escalating to Serious Events

Priority Questions

- What are the top five near-miss or unsafe conditions in transportation that have the highest likelihood of progressing to serious incidents?
- What factors contribute to transportation unsafe/near miss incidents?
- Who suffers from transportation related unsafe conditions?
- What are effective ways that DOT can reduce the occurrence of unsafe conditions and near miss incidents that lead to transportation related injuries and fatalities?

Background

For every major accident, there is a progressively increasing number of less serious safety incidents and occurrences.[63] However, there are other safety incidents in which an accident is narrowly avoided, also known as near misses. The conditions that lead to an unsafe situation on one occasion can result in a real accident on another. While the term "near-miss" suggests a proximity of time or space, that is not always the case. The conditions leading to an accident may have already existed for a long time, and thus there may also be an opportunity to take corrective action to avoid an accident ever occurring. If identified, analyzed, and disseminated, these so-called "near-misses" represent a valuable source of information, which could be applied to the prevention of more serious and devastating transportation accidents.

Over the past thirty years, the DOT has become increasingly involved in developing and implementing standards of reporting of these near-miss incidents. This proactive approach has become a primary strategy for identifying and responding to potential failures before they have the opportunity to cause serious harm. DOT has already applied this approach to four modes of transportation. The Federal Aviation Administration (FAA) collects information on unsafe situations/near misses in the aviation industry. The Federal Railroad Administration (FRA) has been collecting data on near misses from a limited number of regional railroads and Amtrak. Bureau of Transportation Statistics (BTS), working together with the Maritime Administration (MARAD), conducted a pilot study (SafeMTS) of near-miss incidents reported by maritime companies and published its results in January 2024.[64] BTS has been collecting near-miss reports on transit operations by Washington Metropolitan Area Transit Authority (WMATA) employees for over a decade.

This learning agenda topic explores the transferability of DOT's ongoing near-misses data collection and reporting experiences to other modes of transportation. It considers identifying efficient and effective ways to secure reports of near-miss events across transportation modes. It also seeks to find ways to classify causes of unsafe situations/near misses across modes of transportation in a meaningful way that will permit compiling of statistical data, which would allow DOT to expand the scope of preventive efforts to include conditions that occur most often and pose the greatest potential for adverse outcomes.

Operating Administration

Office of the Under Secretary for Transportation Policy (OST-P)

Office of the Assistant Secretary for Research and Technology (OST-R)

Bureau of Transportation Statistics (BTS)

Maritime Administration (MARAD)

Federal Transit Administration (FTA)

Federal Motor Carrier Safety Administration (FMCSA)

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[63] Major accident includes any undesirable event resulting in damage or harm to an individual(s), environment, or property.

[64] DOT, BTS (2023) *SafeMTS: Report on the Pilot,* https://rosap.ntl.bts.gov/view/dot/73113.

Alignment with DOT Strategic Plan

- Strategic Goal: Safety
  - Strategic Objectives:
    - Safe Public
    - Safe Workers
    - Safe Design
    - Safe Systems

Evidence Building Plan

Recently Completed Evidence-Building Activities

BTS has been collecting near miss data from seven maritime companies (SafeMTS) and plans to expand this program to the entire maritime industry.

BTS has been collecting near miss data from one transit agency (WMATA) for more than a decade.

FAA has several data systems that include information on near-miss incidents primarily reported by FAA or airline employees.

FRA's Confidential Close Call Reporting System (C3RS) includes information on near-miss incidents primarily reported by employees of regional rail companies.

Although factors that predispose certain common causal factors tend to fall into the same categories across modes, there are no existing sources that capture causal factor data across all modes, preventing DOT from developing national risk estimates. BTS plans to collaborate with potential partner agencies/industries to explore the feasibility of capturing the missing information across all modes, including through the implementation of uniform taxonomies.

Planned Evidence-Building Activities

In developing a data collection plan, BTS seeks to identify key factors contributing to transportation unsafe conditions and near-miss incidents across all modes. Insight into these key factors would help prevent transportation unsafe conditions and near-miss incidents from escalating to more serious and tragic events. It could also inform the development of methods to forecast causal factors contributing to unsafe conditions/near misses across modes.

Collection of such multi-modal data on unsafe conditions and near misses would be filling a key evidence gap for understanding the relationship between reduction of injuries and fatalities through preventive safety actions.

Known or Potential Data

While there are existing sources, they are disparate and extremely limited to identify causal factors of safety incidents across all modes. BTS could leverage experience from existing near-miss programs like aviation (FAA), rail (FRA) and transit (BTS – WMATA Close Call Program) and complete data gaps through additional data collections.

Methods and Analytical Approaches

BTS has developed a method to identify causal factors of unsafe conditions in transit operations based on near-miss data reported by WMATA workers. Using the current approach and adjusting for modal differences, BTS could create a transportation incident risk profile for individual modes as well as the entire transportation system.

Anticipated Challenges and Mitigation Strategies

Lack of comprehensive data collected in a systematic and standardized way across all modes is the biggest challenge in addressing the priority questions.

To fill in existing data gaps, BTS has started to explore with partners within DOT (MARAD, FTA) and across the respective industries the feasibility of collecting data.

Partnering with agencies that are currently conducting national health/safety surveys (e.g., the National Center for Health Statistics's Health Interview Survey) will allow us to embed questions to gather data on transportation unsafe conditions at a relatively low cost to the government. This in turn will provide evidence for the value of this data to support annual appropriations requests and a new data program in the next reauthorization.

BTS expects that there may be considerable challenges related to differences in operating environments and intricacies of multilateral relationships between government officials, private industry, workers, and other stakeholders.

Photo Credit: DOT

STRATEGIC GOAL:
ECONOMIC STRENGTH & GLOBAL COMPETITIVENESS

The Economic Strength & Global Competitiveness section presents a plan to build evidence to foster the growth the Nation's economy through a transportation system that provides reliable and efficient access to resources, markets, and good-paying jobs. It introduces three new Economic Strength & Global Competitiveness topic areas, each containing a set of priority questions. Together they cover Establishing the National Multimodal Freight Network, Modeling the National Freight Network, and developing an evidence-base for the National Maritime Strategy. In addressing these priority questions, the DOT will fill crucial Economic Strength & Global Competitiveness evidence gaps that will be used to inform policy, regulatory, and operational decisions.

National Freight Network Modeling

Priority Questions

- How much is freight traffic by mode projected to grow, and how can DOT improve the models that generate these projections?
- How can DOT maintain a safe system, considering increased freight volumes?
- What network strategies are effective in improving the resilience of our freight infrastructure?
- Which improvements to freight infrastructure best support America's path to net-zero emissions?
- What are America's core freight transportation assets today?
- How well do core freight transportation assets perform, and where do issues exist?
- How reliable and well connected is the freight transportation system, considering its multimodal nature and supply chain needs?
- To what extent do smaller businesses have equitable or expanding access to the freight system?
- What role does the freight system serve in climate justice and environmental justice, and what strategies enable the freight system to support these areas more effectively?

Background

America's freight system is a complex, interdependent, multimodal system of infrastructure and services owned and operated by a mix of public and private sector entities. The system comprises physical infrastructure or facilities, such as ports, waterways, airports, railroads, pipelines, roadways, and warehouses, as well as diverse carriers, shippers, and suppliers that use this infrastructure to transport goods. In 2018, the U.S. transportation system moved a daily average of about 51 million tons of freight valued at nearly $52 billion.

Our Nation's multimodal freight transportation system is indispensable to the U.S. economy and impacts the environment, safety, and equity. DOT will continually need to implement policies, programs, and investments to ensure a reliable, safe, and efficient multimodal freight system for years to come. However, DOT has four critical gaps in its understanding of the multimodal freight transportation system.

First, DOT does not have a systematic, data-driven mechanism to assess how the multimodal freight transportation system will respond to alternative transportation policies, investments, or system disruptions. Currently, each Operating Administration collects data on freight volumes for their mode, focusing on current and historical trends. This data collection makes it difficult to measure performance across the integrated, multimodal freight system.

Second, DOT data users currently cannot accurately analyze the detailed flows of multimodal freight and parcel shipments since DOT data represent all of these flows together in a single category (the "Multiple Modes and Mail" mode). More specific knowledge of which modes are used and whether the goods are containerized, bulk, or parcel, is needed.

Third, DOT tools lack visibility into the supply chains that drive freight transportation demand. DOT tools and data represent the transportation volumes that result from the movement of goods between production locations and consumption locations, and they represent international trade with a low level of detail. However, the tools and data do not typically represent the underlying production and consumption locations. Visibility of the underlying production and consumption patterns, including improved international trade representation, is necessary for supply chain and resilience studies.

Fourth, DOT decisions frequently rely on disparate data from agencies such as states and metropolitan planning organizations, which use different assumptions and methods to estimate impacts. State and local agencies also have different capabilities – one agency might estimate future intermodal volumes, while another agency might lack that capacity. As a result, DOT decisions regularly rely on evidence that is missing critical data and is not developed in a systematic way.

The Bureau of Transportation Statistics (BTS) will develop a new modeling system for the Department that addresses these four evidence gaps: a DOT freight decision support tool called the National Freight Modeling System (NFMS). BTS's vision is to transform DOT's ability to generate evidence for decision-making. The tool will improve Departmental capacity to advance data-driven programs, policies, and investments that support a wide range of priorities. BTS proposes leveraging the existing Freight Analysis Framework (FAF) data and modeling system, which already contains many features that support DOT's *Learning Agenda*.[65] BTS's aim is to extend FAF's capabilities and deploy it as a decision support tool (the NFMS). The new modeling system will be capable of scenario analysis, which will allow DOT to estimate the potential impacts of both proposed changes as well as unlikely events such as port closures. The model could also be used by other federal agencies with multimodal freight transportation infrastructure questions, such as the U.S. Department of Agriculture or the U.S. Army Corps of Engineers.

Operating Administration

Office of the Under Secretary for Transportation Policy (OST-P)
Office of the Assistant Secretary for Research and Technology (OST-R)
Bureau of Transportation Statistics (BTS)
Office of Multimodal Freight Infrastructure and Policy (OST-F)

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[65] Freight Analysis Framework at https://www.bts.gov/faf

Alignment with DOT Strategic Plan

- Strategic Goal: Safety
    - Strategic Objective: Safe Systems
- Strategic Goal: Economic Strength and Global Competitiveness
    - Strategic Objective: System Reliability and Connectivity
- Strategic Goal: Climate and Sustainability
    - Strategic Objective: Infrastructure Resilience
- Strategic Goal: Transformation
    - Strategic Objective: Collaboration and Competitiveness
- Strategic Goal: Organizational Assessment
    - Strategic Objective: Data-Driven Programs and Policies

Alignment: Other Guiding Documents

- DOT Climate Action Plan
- U.S. National Blueprint for Transportation Decarbonization
- National Roadway Safety Strategy and activities in the Progress Report
- Intermodal Transportation Database[66]
- U.S.C. 49 §6303
- OMB's Multi-Agency Research and Development Priorities for the FY 2024 Budget[68]
- DOT Research, Development, and Technology Strategic Plan for FY 2022-2026 and the Annual Modal Research Plans

Evidence Building Plan

Recently Completed Evidence-Building Activities

In FY 2023 and FY 2024, BTS undertook an internal product visioning exercise. First, BTS conducted a thorough Program Assessment of its Freight Analysis Framework (FAF) data program.[68] Next, BTS then determined how to enrich FAF to improve its useability. BTS identified a series of improvements to implement incrementally. The first stage of improvements is in progress, including:

- Introducing multimodal analysis capability
- Improving analysis of forecasted mode shares
- Improving useability for state and local agencies by providing commodity flows at the county level

BTS also discussed program assessment, ongoing (first stage) improvements, and proposed improvements (described in the next row) with many DOT and other federal stakeholders. BTS incorporated their feedback into its vision. BTS presented its plans at multiple sessions of the 2024 Transportation Research Board (TRB) Annual Meeting. BTS conducted an additional virtual forum to present the vision for FAF modernization and a potential scenario modeling tool in June 2024.

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[66] Intermodal Transportation Database at https://www.bts.gov/browse-statistical-products-and-data/statistical-products/intermodal-transportation-database.
[67] OMB (2022) M-22-15, https://www.whitehouse.gov/wp-content/uploads/2022/07/M-22-15.pdf.
[68] Starting in October 2023, BTS is the sole producer of FAF. Previously, FAF was a collaboration between BTS and FHWA. The first three versions of FAF were produced solely by FHWA.

Planned Evidence-Building Activities

BTS seeks to identify multimodal freight analysis needs across DOT, develop methods to address these needs, identify data requirements, and conduct model development. The transformation of FAF to a decision support tool could involve several activities, including:

- Modernizing computational processes and data sources

- Expanding multimodal focus to include pipelines, air, and last-mile freight

- Accounting for the availability of mobile supply (e.g., truck fleets, chassis). As witnessed during the pandemic, they are critical to the health of the nation's ports, rail yards, and supply chains. However, tools usually don't include these features.

- Projecting future demand for multimodal freight

- Providing enough granularity to address priority questions in the *Learning Agenda*

- Validating the model system to ensure performance in scenario analysis of both demand and supply.

- Developing a model system to analyze scenarios, similar to the Energy Information Administration's National Energy Modeling System (NEMS).

Developing a National Freight Modeling System (NFMS) would fill a key analytical gap for addressing the effectiveness of potential multimodal freight transportation strategies.

Known or Potential Data

Since BTS proposes to leverage an existing program, it already collects, accesses, and processes substantial amounts of data.[69] BTS will utilize current sources including the Commodity Flow Survey, Vehicle Inventory and Use Survey, USDA crop production, USGS mineral production, and others. However, the data sources that are used for FAF have been mostly the same for the last 20 years. BTS proposes enriching the model system with the following:

- Multimodal transshipment location data: BTS' National Transportation Atlas Database

- Multimodal routing data: Highway routing data are part of FAF. BTS is working with FRA, Volpe, and USACE to develop rail system and inland waterways data (using Waybill, Waterborne Commerce flows, Lock Performance data, and other inputs)

- Travel time and reliability data, highway network: BTS's Freight Mobility Initiative data

- Travel time and reliability data, inland water network: BTS is creating this data with USACE support

- Travel time and reliability data, rail network: This is a gap and BTS is exploring ways to address it

- Truck GPS/telematics data: This data will use BTS's Freight Mobility Initiative data

- Nationwide dataset of establishments and/or land use: This is a gap and BTS is exploring ways to address it

- Last-mile ecommerce delivery: BTS developed a white paper proposing a Household Logistics Data Program

We would also benefit from access to the Customs and Border Protection Manifest data.

Tools

Potentially: R, Python, C++, as well as commercially available GIS software platforms. BTS envisions a cloud-based application, possibly using an API as well, and in FY 2023 started exploring this as part of the internal FAF Technology Modernization effort.

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[69] Oak Ridge National Laboratory (2021) *Freight Analysis Framework Version 5 (FAF5) Base Year 2017 Data Development Technical Report,* ORNL/TM-2021/2154, https://faf.ornl.gov/faf5/data/FAF5_Base_Year_Method_12-2021_FINAL.pdf.

Methods and Analytical Approaches

The approach to commodity flow (demand) estimation will rely on statistical and econometric modeling, possibly supplemented with machine learning. The approach to multimodal network (supply) modeling will continue to rely on standard transportation simulation methods, namely static assignment. BTS will integrate the demand and supply components using multiresolution travel demand modeling methods. BTS anticipates using a hybrid approach that uses disaggregate methods for some features (such as shipment-related decisions) and aggregate methods for others (such as traffic assignment).

Anticipated Challenges and Mitigation Strategies

A project of this scope requires careful management of complexity and risk. Stakeholders may have questions or uncertainty about the tool – how to use it or leverage its value. Similarly, intra-agency coordination is not to be taken for granted. Intensity of data requirements and data availability are important considerations. Quality of the final product can be a challenge if BTS does not create a plan to assure quality.

To manage complexity and risk, BTS will ensure that the new model has methodological precedents – that its subcomponents and data sources are well vetted in the transportation modeling community. BTS will ensure that the new process is straightforward, transparent, and well documented. BTS currently uses vendors to provide staffing redundancy in case key staff depart the agency. BTS also met with NEMS developers in FY 2023 and expect to continue that dialogue to hear and integrate lessons learned into the process.

We need to bring along stakeholders as BTS changes methodology. BTS plans to accomplish this via regular user engagement/ feedback to ensure that the emerging product will support their needs.

Coordination with other BTS data programs is essential. BTS plans to analyze any prospective new data sources based on (1) expected future availability; (2) transparency; (3) cost, with a strong preference for public (or federal special table) data where possible. Moreover, BTS will design processes so that any likely data gap has minimal consequences. Finally, ensuring product quality is paramount. To do so, BTS will conduct extensive validation during product development and extensive testing of the final product. BTS will adjust its approaches and data sources as needed to maintain quality.

Establishing a National Multimodal Freight Network

Priority Questions

As the Department works on establishing a National Multimodal Freight Network, what can be learned from how other countries have created similar networks?

Background

DOT is establishing a National Multimodal Freight Network to assist States in strategically directing resources toward improved system performance for the efficient movement of freight on the Network, to inform freight transportation planning, and to assist in the prioritization of Federal investment.

During this process, there are opportunities to learn what evidence-based practices other countries have that the United States might learn from or adapt. Crossways is a new initiative built off the *Momentum* program and based in Office of the Secretary's Under Secretary for Transportation Policy's Office of International Transportation and Trade (OST-X20) that seeks to facilitate knowledge exchange on transportation best practices from around the world.[70] The areas of study are primarily derived from the Department's strategic priorities, but other offices across the department are encouraged to partner with Crossways on specific topics and research questions.

Crossways accomplishes these evidence building goals in two ways. First, it conducts and disseminates research on international best practices and analyzes information from transportation experts and systems around the world. Second, it provides opportunities for capacity building and connections by bringing together American policy makers, all levels of government, experts, and communities with their international counterparts. Crossways intends to support the Department's efforts to support U.S. transportation on time, on task, and on budget.

Operating Administration

Under Secretary for Transportation Policy
Office of Multimodal Freight Infrastructure and Policy (OST-F)
Office of International Transportation and Trade (OST-X)

Alignment with DOT Strategic Plan

- Strategic Goal: Safety
- Strategic Goal: Economic Strength and Global Competitiveness
    - Strategic Objective: Resilient Supply Chains
- Strategic Goal: Climate and Sustainability
    - Strategic Objective: Infrastructure Resilience
- Strategic Goal: Transformation
    - Strategic Objective: Matching Research and Policy to Advance Breakthroughs
- Strategic Goal: Organizational Excellence
    - Strategic Objective: Data-drive Programs and Policies

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[70] *Momentum* program at https://www.transportation.gov/momentum.

Evidence Building Plan

Recently Completed Evidence-Building Activities

In January 2024, Crossways partnered with DOT's new Office of Multimodal Freight Infrastructure and Policy (OST-F) to conduct research about what other countries have done in planning freight corridors.[71] After the initial research reviewing other high- and middle-income countries, Australia and the European Union were found to have the most relevant systems to the United States. Crossways conducted researched and produced a report (not yet released publicly) entitled International Best Practices on Freight Corridor Planning: Lessons from Australia and the European Union.

The report gave an overview of freight corridors in both regions, including challenges faced. It dissected the process in which both planned their corridors, looking at specific steps, such as how focus groups from different sectors met to advise the planners, and the methodologies used to choose the specific corridors. It also looked at how the corridors were used as a planning tool, mapping out future growth opportunities and incorporating environmental pressures from climate change. The report explored what was included in the corridors, why it was included, and how they chose the data points. Most importantly, it included a lessons learned section on systems that had recently undergone five-year reviews.

In spring 2024, the report was presented to the cross-DOT steering committee to inform discussions. Crossways also arranged a meeting between DOT's Office of Multimodal Freight Infrastructure and Policy and Australia Infrastructure to provide an opportunity for DOT to learn more about Australia's corridor planning process. For example, there was useful qualitative and process information about how Australia sought input from private sector, academia, and local and state governments that were successful in garnering widespread support for the plan.

Planned Evidence-Building Activities

Setting up a discussion with the European Union about their freight network, similar to the meeting described above with Australia.

Known or Potential Data

Literature review of government documents, website, publications, archives, etc., as well as peer learning during meetings and forums.

Tools

Access to online journals, news, and publications, meeting space, funding for study tours and workshops, and technology such as Zotero (to organize research).

Methods and Analytical Approaches

Primarily qualitative research such as a broad scan of the work of other countries, states, and cities on innovative transportation solutions. This is followed by more in-depth reading of case studies and available materials, followed by further interviews and observation and site visits if possible. Additional quantitative research methods may be developed.

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[71] Office of Multimodal Freight Infrastructure and Policy at https://www.transportation.gov/freight.

Anticipated Challenges and Mitigation Strategies

A primary challenge has to do with getting buy-in and responses from foreign governments to share best practices. While some countries were eager to share their experience, they were hampered by staff changes and a loss of firsthand knowledge.

Continue to build relationships and connections with relevant stakeholders at all levels: DOT, U.S. cities, foreign governments, embassies, etc.

Photo Credit: Getty Images

National Maritime Strategy

Priority Questions

- What policies, programs, and interventions demonstrate high potential for revitalizing the U.S. merchant marine and maritime industrial base?
- What policies, programs, and interventions demonstrate high potential for revitalizing the shipbuilding industrial base?
- To what extent are DOT's various approaches effective at supporting the viability of the U.S. flag commercial fleet in international trade and meeting U.S. economic and national security needs?

Background

The Maritime Administration (MARAD) is responsible for supporting and developing the Nation's marine transportation system so that it is sufficient to move all domestic and a substantial portion of foreign international waterborne commerce to accommodate economic growth and provide military sealift and humanitarian aid response during national emergencies. This responsibility includes landside infrastructure, the ability to seamlessly move cargo between the water and other surface modes, and sealift capacity to efficiently move goods from port to port. Given MARAD's strong national security role, MARAD also must ensure that the Nation can educate and train U.S. citizen mariners to crew the ships that carry foreign and domestic commerce.

Recognizing MARAD's important role and the evolving challenges facing the maritime transportation system, Section 3542 of the National Defense Authorization Act (NDAA) for Fiscal Year 2023 set forth requirements for a new National Maritime Strategy.[72] The law requires that MARAD select a federally funded research and development center (FFRDC) to identify the key elements and objectives it needs to develop a U.S. maritime strategy that will revitalize the U.S. merchant marine and the maritime industrial base to meet the Nation's economic and national security needs. In addressing these priority questions, MARAD will develop an evidence-base to inform the development of the National Maritime Strategy.

Operating Administration

Maritime Administration (MARAD)

Alignment with DOT Strategic Plan

- Strategic Goal: Economic Strength and Global Competitiveness
  - Strategic Objectives:
    - Job Creation and Fiscal Health
    - Resilient Supply Chains
- Strategic Goal: Organizational Excellence
  - Strategic Objective: Data-Driven Programs and Policies

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[72] Public Law 117-263

Alignment: Other Guiding Documents

- Goals and Objectives for a Stronger Maritime Nation: A Report to Congress[73]
- National Freight Strategic Plan[74]
- MARAD's Strategic Plan FY 2022-2026[75]
- National Security Strategy[76]
- National Defense Authorization Act (NDAA) for Fiscal Year 2023[77]
- National Defense Industrial Strategy[78]

Evidence Building Plan

Recently Completed Evidence-Building Activities

MARAD hired the Center for Naval Analysis (CNA) in fall 2023 to conduct a study that will assist MARAD in developing an evidence-based National Maritime Strategy. CNA is expected to deliver the final report in November 2025.

As of July 2024, CNA had conducted extensive outreach to the industry and federal stakeholders and will continue to do so through fall 2024. The input gathered from stakeholders will help identify the key elements and objectives of the NMS. CNA completed an analysis and provided MARAD with a document that established a baseline of capabilities and projections for economic and national security. Additionally, CNA also provided MARAD with future requirements for economic and national security.

By the first quarter of FY 2025, CNA is expected to provide a preliminary report on the study findings to MARAD detailing critical requirement gaps in the U.S. maritime industry to meet the Nation's economic and national security needs and provide a suite of options to address those gaps in meeting those requirements. This preliminary report will include findings from two Wargaming exercises held in July 2024 that convened federal and private stakeholders in the U.S. maritime industry. The Wargaming exercise brought maritime stakeholders together in a structured, problem-focused environment to discuss the short, medium, and long-term problems and challenges in the U.S. commercial maritime industry, find common ground, and explore potential solutions. The first Wargame focused on the shipping industry, while the second game focused on the shipbuilding industry. The Wargaming exercises focused on the problems associated with commercial shipping capacity in support of a large-scale national security crisis. They also identified actions that can be taken now to promote regrowth in the commercial maritime industry and the maritime transportation system.

Planned Evidence-Building Activities

The project is using numerous commercial public and private data sources on the maritime industry, transportation industry, shipbuilding industrial base, supply chain, and numerous commercial industry sectors. It is also using findings from the two Wargaming exercises described above.

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[73] DOT, MARAD (2021) *Goals and Objectives for a Stronger Maritime Nation: A Report to Congress,* https://www.maritime.dot.gov/outreach/policy-papers-and-fact-sheets/national-maritime-strategy.

[74] DOT (2020) *National Freight Strategic Plan*, https://www.transportation.gov/freight/NFSP

[75] DOT, *MARAD Maritime Administration Strategic Plan FY 2022-2026: Navigating a Stronger Future*, https://www.maritime.dot.gov/about-us/strategic-plan-fy-2022-2026-navigating-stronger-future

[76] Office of the President (2022) *National Security Strategy*, https://www.whitehouse.gov/wp-content/uploads/2022/11/8-November-Combined-PDF-for-Upload.pdf

[77] Public Law 117-263

[78] DOD (2022) *The National Defense Industrial Strategy*, https://www.businessdefense.gov/NDIS.html

Known or Potential Data

The project is using numerous commercial public and private data sources on the maritime industry, transportation industry, shipbuilding industrial base, supply chain, and numerous commercial industry sectors. It is also using findings from the two Wargaming exercises described above.

Tools

The agency has the tools from both the public and private sector to develop an evidence-based National Maritime Strategy. MARAD will use its current data and information resources which include, historical documents, interactive online data tools, and in house DOT approved software. The project is currently using data from Customs and Border Protection, U.S. Census Bureau, Army Corps of Engineers, USDA, BTS, FHWA, FRA, IHSGlobal, Alphaliner, Drewry, Vessels Value, Argus, and over a dozen other private and commercial sources.

MARAD also plans to use meeting venues to convene stakeholders for discussion on the strategy.

Methods and Analytical Approaches

Primarily gathering and compiling industry baseline data, as well as forecast analysis based on the current state of the economy and existing capabilities.

Anticipated Challenges and Mitigation Strategies

The principal challenge is that the commercial maritime industry is broad and far reaching, and subject to rapid change due to both internal and external influences. Determining the level of detail to formulate an effective strategy will also be challenging.

Mitigation strategies include:

- Prioritizing the most critical elements of the commercial maritime industry that need to be addressed
- Prioritizing the most urgent needs to revitalize the commercial maritime industry and Shipbuilding industrial base
- Scenario planning to assess national outcomes
- Learning from strategies that others are using to address commercial maritime industry concerns

STRATEGIC GOAL: EQUITY

The Equity section shares a roadmap for building evidence to support the reduction of inequities across all communities by promoting safe, affordable, accessible, and multimodal access to opportunities while reducing transportation-related disparities, adverse community impacts, and health effects. This section contains three new Equity topic areas with priority questions nested underneath covering Transportation Insecurity, the National Transit Map, and Transit Oriented Development. By addressing these priority questions, DOT will fill crucial Equity evidence gaps that will be used to inform policy, operational, and regulatory decisions.

Transportation Insecurity

Priority Questions

- What is the prevalence of transportation insecurity in the U.S.?
- What factors contribute to transportation insecurity? How do the contributing factors vary across demographic and geographic characteristics?
- Who suffers from transportation insecurity? How do rates of transportation insecurity vary across demographic and geographic characteristics?
- What policies and practices are effective for reducing (or mitigating) transportation insecurity, particularly in areas disproportionately affected?
- How is transportation insecurity related to food and housing insecurity?

Background

A growing body of research indicates that transportation insecurity is a significant factor in persistent poverty. Households spent an average of $12,295 on transportation in 2022—the second largest household expenditure category after housing. In 2022, the lowest income households spent over 30 percent of their after-tax income on transportation.[79] While there are well-established Federal policies and programs that aim to address food insecurity and housing insecurity, there are none for transportation insecurity. Further, there is not yet a Federal government-wide definition of transportation insecurity.

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[79] When excluding spending on behalf of households, such as healthcare. U.S. DOL, BLS (2022) "Consumer Expenditure Survey," https://www.bls.gov/opub/reports/consumer-expenditures/2022/.

Like food insecurity and housing insecurity, transportation insecurity is related to inequity and poverty. Leveraging a nationally representative online panel, researchers at the University of Michigan found that one in four U.S. adults aged 25 and older experience transportation insecurity. They estimated that more than half of people living below the poverty line experience transportation insecurity – which is higher than the rate of people in poverty who experience food insecurity. They also found that transportation insecurity occurred more frequently among Black adults (33 percent) and Hispanic adults (29 percent) than White adults (12 percent).[80]

A nationwide data program is needed to build robust evidence so programs and policies can be developed to promote mobility justice and combat poverty. To this end, DOT is working to develop a transportation insecurity index. This index will allow DOT to make evidence-based decisions to prioritize programs, policies, and investments that target inequity and poverty. It will also assist state and local agencies in prioritizing projects that will reduce the number of people experiencing transportation insecurity.

Definitions:
- Transportation insecurity: The condition in which people are unable to satisfy their travel needs safely, regularly, reliably, and affordably.
- Transportation affordability: Households' ability to purchase basic mobility (e.g., owning and operating household vehicles, bus tickets, etc.) within their limited budgets to access basic goods and activities (e.g., medical care, basic shopping, education, work, and socializing). BTS considers transportation unaffordable if it is more than 15 percent of a household's income or more than 45 percent of housing plus transportation costs.

Operating Administration

Office of the Under Secretary for Transportation Policy (OST-P)

Office of the Assistant Secretary for Research and Technology (OST-R)

Bureau of Transportation Statistics (BTS)

Alignment with DOT Strategic Plan

- Strategic Goal: Equity
  - Strategic Objective: Expanding Access
    - Performance Goal: Reduce national transportation cost burden by 5%, including transportation travel cost as a percent of income by FY 2030

Alignment: Other Guiding Documents

- DOT Equity Action Plan
- DOT Equitable Transportation Community (ETC) Explorer[81]
- Transportation Insecurity Analysis Tool (TIAT)[82]

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[80] A. Murphy, K. McDonald-Lopez, et al. (2022) "Transportation Insecurity in the United States: A Descriptive Portrait," *Socius, 8*, https://doi.org/10.1177/23780231221121060.

[81] ETC Explorer at https://www.transportation.gov/priorities/equity/justice40/etc-explorer.

[82] TIAT at https://www.transportation.gov/priorities/equity/justice40/transportation-insecurity-analysis-tool.

Evidence Building Plan

Recently Completed Evidence-Building Activities

Publicly available data do not currently exist on transportation insecurity, but models of transportation cost burden, one aspect of transportation insecurity, exist. The existing models were dated and left room for improvement. BTS has been working to build a better model of transportation cost burden. This model will have pre/post pandemic numbers, more precise estimation approaches for vehicle and transit use, the ability to adjust for cost-of-living differences and several estimates at the tract level. This project has been ongoing since FY 2022.

In the process of developing the transportation cost burden model, it became clear that cost burden was only one piece of what BTS needed to understand to ensure a transportation system that serves people's daily needs. Transportation insecurity is a more comprehensive measure.

BTS has been conducting a literature review of existing measurement and data sources of transportation insecurity.

DOT does not currently have an established and validated measure of transportation insecurity, and accordingly, does not currently collect data on transportation insecurity. There are no existing publicly available sources that capture transportation insecurity. The University of Michigan team's transportation insecurity index was reviewed but deemed insufficient for DOT's needs due to a difference in focus and definition of transportation insecurity. To address this gap, the team has been meeting with potential partner agencies for adding questions about transportation insecurity to existing data collections.

In addition, BTS will produce a feasibility study to determine the resources needed to stand up a standalone survey and/or to embed transportation insecurity questions in existing federal surveys.

In FY 2023 and 2024, the team has been developing plans for a future stand-alone data collection. This stand-alone data collection may be administered by DOT or, more likely, administered as a supplement to another survey similar to the food security supplement on the CPS.

Planned Evidence-Building Activities

BTS seeks to identify factors contributing to transportation insecurity, develop a method to estimate transportation insecurity index, develop a data collection plan, and initiate data collection. Activities could include:

- Identifying factors contributing to transportation insecurity
- Developing a method to estimate transportation insecurity index and determine key data elements to collect.
- Identifying key surveys to partner with and advocating to add transportation insecurity survey questions
- Developing survey questions in relation to existing questionnaire of the partnering surveys
- Conducting cognitive test and debriefing of new survey questions
- Entering an interagency agreement with partnering agencies to include transportation insecurity questions in target surveys

Collection of transportation insecurity data would fill a key data gap for understanding transportation equity.

Known or Potential Data

There is no existing source that is able to estimate transportation insecurity.

Tools

To answer the priority questions above, BTS needs to develop a method to estimate a transportation insecurity index and collect necessary data for the estimation method.

Methods and Analytical Approaches

BTS will develop a method to estimate a transportation insecurity index and collect data needed for the estimation. BTS will aim to create an index for individual state and major metropolitan areas.

Anticipated Challenges and Mitigation Strategies

The Department is exploring partnering with other government agencies on their existing surveys to collect data requires that the agencies leading these existing surveys have the interest and space to add questions. Partnering with agencies that are currently conducting national surveys would allow us to embed questions to gather data on transportation insecurity at a relatively low cost to the government. However, all agencies conducting federal surveys must be cognizant of burdening the public, so space is typically very limited. Advocating additional questions to existing surveys and maintaining ongoing relationship with these agencies may pose foreseen challenges.

BTS is starting the conversations with partner organizations. BTS has prepared justifications for why this question is valuable not just to DOT, but also to the partner organizations. Multiple agencies BTS has contacted so far have shown interest and openness to adding a question(s) on transportation insecurity to their survey, so this seems to be an effective strategy.

Partnering with agencies that are currently conducting national surveys will allow us to embed questions to gather data on transportation insecurity at a relatively low cost to the government.

National Transit Map

Priority Questions

To what extent are transportation disadvantaged communities served by fixed-route and demand response public transit?

Background

A key component of the Federal Transit Administration (FTA)'s mission is to expand transportation options for disadvantaged populations. FTA programs support transit investments that address disparities in access to quality transit services. Many communities have been overlooked in the past because of their rural location or have suffered from the ongoing legacy of racial discrimination.

FTA requires all transit agencies receiving federal funding to report to the National Transit Database (NTD) on an annual basis.[83] While the National Transit Database collects many data points related to transit service provided, it only began collecting geographic service area data beginning in late 2023. With limited availability of geospatial service area coverage in the past, it has been challenging for FTA to measure the extent to which low income and other traditionally underserved populations are able to access public transportation. FTA is addressing this knowledge gap by collecting geographic service area coverage data from transit agencies beginning in FY 2024. FTA plans to track access to fixed route and demand response transit services by geographic area with the DOT Bureau of Transportation Statistics (BTS)'s National Transit Map using the newly-available data from transit agencies, DOT's Equitable Transportation Community (ETC) Explorer, and the FTA Census Map.[84]

Prior to 2024, the National Transit Map relied on data submitted by transit agencies on a voluntary basis.[85] Section 30014 of the Bipartisan Infrastructure Law provided for geospatial data collection by granting FTA the authority to collect geographic service area coverage data through the National Transit Database. To meet this data reporting requirement, transit agencies provide FTA the commonly used General Transit Feed Specification (GTFS) data for fixed-route transit service, including information on routes, stops, and schedules.[86] This requirement would move toward more complete coverage of fixed-route transit service. For demand response transit service, National Transit Database reporters respond to a survey about which Census places they operate in and whether they provide partial or full coverage.[87]

Operating Administration

Federal Transit Administration (FTA)
Office of the Under Secretary for Transportation Policy (OST-P)
Office of the Assistant Secretary for Research and Technology (OST-R)
Bureau of Transportation Statistics (BTS)

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[83] National Transit Database at https://www.transit.dot.gov/ntd.

[84] Fixed-route transit service is services provided on a repetitive, fixed schedule basis along a specific route with vehicles stopping to pick up and deliver passengers to specific locations. FTA Census Map at https://www.transit.dot.gov/ntd/fta-census-map.

[85] National Transit Map at https://www.bts.gov/national-transit-map.

[86] General Transit Feed Specification (GTFS) is an open standard used to distribute relevant information about transit systems to riders. It allows public transit agencies to publish their transit data in a format that can be consumed by a wide variety of software applications. Source: https://gtfs.org/documentation/overview/

[87] Census places are any officially incorporated village, borough, municipality, city, town etc. or a Census designated place.

Alignment with DOT Strategic Plan

- Strategic Goal: Equity
    - Strategic Objectives:
        - Expanding Access
        - Power of Community
        - Proactive intervention, Planning, and Capacity Building

Alignment: Other Guiding Documents

- DOT Equity Action Plan
- DOT Research, Development, and Technology Strategic Plan for FY 2022-2026 and the Annual Modal Research Plans

Evidence Building Plan

Recently Completed Evidence-Building Activities

In July 2022, FTA published a notice in the *Federal Register* on the National Transit Database's reporting changes and clarifications and requested comments.[88]

Beginning in fall 2024, all reporting transit agencies are required to submit their GTFS data for fixed route service and survey response data for demand response service. The new data will be incorporated into the calculation of transportation access used in DOT's Equitable Transportation Community (ETC) Explorer. The new reporting requirement will also support BTS's National Transit Map, increasing the number of transit agencies and services represented.

Planned Evidence-Building Activities

FTA will verify and validate the data, identify any data limitations, and develop data analysis and management standard procedures. BTS will process the data into geospatial layers that can be loaded into a Geographic Information System (GIS) such as ArcGIS. The FTA presents these layers on the FTA Census Map.

Known or Potential Data

Transit agencies will provide GTFS data to FTA for fixed-route transit service. These submissions include information on routes, stops, and schedules. BTS transforms these feeds into geospatial data and produces the National Transit Map's stops and routes layers and will produce geospatial data catalog with entries for each transit agency.

FTA plans to further analyze transit coverage alongside indicators of transit service need using DOT's Equitable Transportation Community (ETC) Explorer, FTA's Census Map, the National Transit Map, and DOT's disadvantaged communities data.[89]

Tools

FTA, in partnership with BTS, will create useful graphic visualizations of nationwide transit service coverage in ArcGIS using the National Transit Map layers and processed GTFS files. BTS is using business intelligence and statistical software to measure data completeness, clean and transform the data. BTS and FTA will then perform analyses and create visualizations.

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[88] DOT, FTA (2022) "National Transit Database Reporting Changes and Clarifications," *Federal Register* (July 7, 2022), Docket No. FTA-2022-0018, https://www.federalregister.gov/documents/2022/07/07/2022-14502/national-transit-database-reporting-changes-and-clarifications#h-11.

[89] DOT's disadvantaged communities data at https://www.transportation.gov/grants/dot-navigator/equity-and-justice40-analysis-tools and https://equity-data.dot.gov/.

Methods and Analytical Approaches

Spatial analysis will be used to calculate the share of fixed-route and demand response transit service available to DOT-identified transportation disadvantaged communities.

Using GIS, FTA will approximate the extent of coverage (e.g., circle radius) around fixed-route transit stops for each transit stop in the BTS National Transit Map. FTA will then perform multi-program analyses to compare coverage across datasets, including with DOT's Transportation Disadvantaged Communities layer. FTA will compare service supplied (e.g., areas within transit coverage) and transit needs (e.g., carless households outside transit coverage) to analyze differing levels of transit access.

Using newly submitted demand response service area coverage data, FTA will be able to see which disadvantaged communities overlap with Demand Response service alongside fixed route transit, which communities have exclusively Demand Response service, and which communities are not connected by either type of service.

The analysis will provide some insights into transit costs and schedules. The National Transit Database collects costs by mode (e.g., Demand Response), giving FTA insight into the total cost of Demand Response service provided by each agency. However, FTA will not be able to parse costs at a lower level, e.g., cost of service for each census place. As demand response does not operate on schedule, there is no schedule information available. However, the NTD does collect hours of service for demand response services.

Anticipated Challenges and Mitigation Strategies

GTFS reporting will be a new process for many transit agencies. FTA expects resolving data completeness and/or validation issues will take time. For example, it is possible that agencies may report erroneous stop locations (e.g., by inverting their latitude and longitude values).

Freshness of GTFS data will vary; while most agencies have submitted live feeds that will be updated whenever they implement service changes, agencies also have the option to submit a static file that will offer only a snapshot of their service area at the time of submission. As a result, the data will be unable to provide an up-to-the-minute picture of transit service coverage in the U.S. The existence of a stop or schedule does not indicate reliability of a service and cannot be obtained from GTFS static feeds.

FTA is working with transit agencies to help them understand and comply with the new reporting requirements.

MobilityData, a nonprofit organization that manages the data specification, maintains the official GTFS Schedule Reference and developed the Canonical GTFS Schedule Validator to help evaluate GTFS schedule datasets against the GTFS Reference and Best Practices.

The National Transit Database team employs this GTFS validation tool to ensure that the submitted GTFS data are complete according to Mobility Data requirements. The validator is limited at present, and it does not validate for spatial accuracy (rather focusing on completeness and data formatting).

The National Rural Transit Assistance Program provides GTFS-related support for reporters, including a GTFS builder, GTFS office hours, technical assistance to a subset of reporters, and hosting feeds for any size reporter. After the first year of data collection is complete, FTA and BTS will assess the need for more technical assistance to support reporters and improve data submissions and consider extending outreach through other channels beyond the National Rural Transit Assistance Program to better engage, for example, with small urban reporters or larger reporters with erroneous data included in their feeds.

Transit Oriented Development

Priority Questions

Was the completion of a Transit Oriented Development (TOD) comprehensive or site-specific planning study associated with an increased likelihood that grantees executed pre-construction activities within three to five years? If so, which types of pre-construction activities (e.g., revised zoning and building codes, finalized land banking plans, revised parking requirements, passage of TOD resolutions, completion of long-range transportation improvement plans, or other follow-on actions) had the strongest association?

Background

The Federal Transit Administration (FTA) administers the Pilot Program for Transit-Oriented Development (TOD) Planning discretionary grant program that provides funding for comprehensive or site-specific planning studies that include a new fixed-guideway or to improve a core-capacity corridor and station(s), affordable housing elements, and mixed-use development.[90] The planning studies aim to accelerate economic development and ridership, increase pedestrian access, encourage multimodal connections, and reduce dependence on personal vehicles.

For some grantees, planning studies on new fixed guideway or core capacity improvement projects lead are followed by initial outcomes within two to five years. These initial outcomes may include revised zoning and building codes, finalized land banking plans, revised parking requirements, passage of TOD resolutions, completion of long-range transportation improvement plans, or other follow-on actions. These initial outcomes may increase the likelihood of achieving long-term equity and climate-related impacts in the target communities.

Answering the priority question can inform FTA on the most likely types of post-TOD planning activities, such as whether TOD program management and leadership should prioritize technical assistance resources and offerings centered on affordable housing, community enhancement, employment access, retail options, and ridership expansion. It will also allow FTA to determine the degree to which grantees who committed to the House America Initiative adhered to this approach.[91]

Operating Administration

Federal Transit Administration (FTA)

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[90] Pilot Program for Transit-Oriented Development Planning at https://www.transit.dot.gov/TODPilot. Fixed guideway investments include "new and expanded rapid rail, commuter rail, light rail, streetcars, bus rapid transit, and ferries, as well as corridor-based bus rapid transit investments that emulate the features of rail." Core-capacity: "Design and construction of a corridor-based investment in an existing fixed guideway system that improves capacity not less than 10 percent in a corridor that is at capacity today or will be in 10 years. The project may not include elements designed to maintain a state of good repair." Source: https://www.transit.dot.gov/funding/grants/fact-sheet-capital-investment-grants-program.

[91] The Housing America Initiative is implemented by the U.S. Department of Housing and Urban Development (HUD) and the U.S. Interagency Council on Homelessness and addresses the homelessness crisis through a Housing First approach. Since FY 2022, FTA's notices of funding opportunity (NOFOs) have included language highlighting our support for this initiative. In FY 2022, 81% of applicants committed to supporting this initiative in their proposals, and in FY 2023, 100% of applicants made the same commitment. Furthermore, for the FY 2022 and FY 2023 selections, FTA prioritized funding proposals that address homelessness and affordable housing.

Alignment with DOT Strategic Plan

- Strategic Goal: Economic Strength and Global Competitiveness
    - Strategic Objective: System Reliability and Connectivity
- Strategic Goal: Equity
    - Strategic Objectives:
        - Expanding Access
        - Proactive Intervention
        - Planning and Capacity building
- Strategic Goal: Climate and Sustainability
    - Strategic Objectives:
        - Path to Economy-Wide Net-Zero Emissions by 2050
        - Climate Justice & Environmental Justice

Alignment: Other Guiding Documents

- Executive Order 13984: Advancing Racial Equity and Support for Underserved Communities Through the Federal Government[92]
- Executive Order 14008: Tackling the Climate Crisis at Home and Abroad
- Justice40 Initiative[93]
- DOT Climate Action Plan
- DOT Equity Action Plan
- DOT Research, Development, and Technology Strategic Plan for FY 2022-2026 and the Annual Modal Research Plans
- DOT FY 2024 Evaluation Plan

Evidence Building Plan

Recently Completed Evidence-Building Activities

FTA's Office of Strategic Planning and Analysis is building on its commitment in the DOT FY 2024 Evaluation Plan to apply a time series evaluation design to identify grant recipient trends in comprehensive planning activities related to partnerships, approvals, and progress toward construction; and measure effects on outcomes including affordable housing, mitigation of gentrification across multiple years including pre- and post-COVID-19, transit access for environmental justice populations, and climate change effects.

FTA issued a statement of work to procure a contractor to complete this plan and awarded a contract in September 2023. Data collection has been underway since October 2023. Grantee progress reports and deliverables are examined for key data points, using a detailed data extraction tool, to identify eligible activities of focus and trends in these areas since 2016. FTA's plan establishes an approach for determining if the pilot program is meeting measurable objectives, collecting evidence to inform future program decisions around specific criteria, and a means of collecting data from grantees.

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[92] "Executive Order 13984 of January 20, 2021 Advancing Racial Equity and Support for Underserved Communities Through the Federal Government" Code of Federal Regulations, 86 FR 7009, https://www.federalregister.gov/documents/2021/01/25/2021-01753/advancing-racial-equity-and-support-for-underserved-communities-through-the-federal-government

[93] Justice40 Initiative at https://www.transportation.gov/equity-Justice40

Planned activities for FY 2024 include the completion of document review using a specific data extraction protocol of key variables (e.g., eligible activities, timelines to completion, performance criteria used to determine effectiveness) through FTA's Transit Award Management System (TrAMS).[94] Evaluators will analyze qualitative data for thematic trends analysis across multiple cohort years. In FY 2025, evaluators will deploy an online survey with grant recipients and hold a series of focus groups among a subset of survey respondents on several areas of grant implementation.

The combination of these efforts will allow FTA to answer the priority question and inform follow-on activities, such as a post-planning study.

Known or Potential Data

TrAMS documents review, regional interviews, grant recipient online survey, grant recipient focus groups.

Tools

Online survey platform (MS Forms); TrAMS platform; Power BI.

Methods and Analytical Approaches

An online survey will be used to identify follow-on activities that grantees have conducted after their planning study. TrAMS document reviews can demonstrate the initiation of planning studies in final progress reports. Grant recipients also have an opportunity to provide qualitative reporting on post-planning implementation plans in TrAMS. A combination of thematic analysis (qualitative data) and descriptive and exploratory analysis on the frequency and types of post-planning activity will be reported.

Anticipated Challenges and Mitigation Strategies

First, collecting survey responses across multiple cohort years may be a challenge, especially from grantees who completed their studies closer to the beginning of the program (2015, 2016, etc.). Nevertheless, a longitudinal approach of collecting data over multiple years is important to answering this question, since some grant recipients are repeat recipients whose focal points have evolved over time.

Second, the survey's response rate may be negatively affected by two other factors. It is possible that repeat grant recipients will be more likely to respond than non-repeaters, creating a systematic difference in the volume of response between the two groups. Some recipients that faced challenges conducting post-planning activities—such as not having enough funding to execute planning projects or initial construction, or not having updated zoning codes to allow for inclusive planning—may be less inclined to respond to the survey. These challenges may lower the survey's response rate.

Third, FTA regional staff and grant recipients self-report their grants management in TrAMS. As with any self-report data system, the data are prone to human error and inconsistencies.

To improve survey response rates, FTA will conduct strong outreach using a repeated exposure approach. A heads-up email for the online survey, along with weekly email reminders over the course of four weeks that the survey is open, can improve response rates. FTA will work closely with regional staff to ensure appropriate points of contact for surveys and focus groups. This approach should also help mitigate noticeable differences between single and repeat grant recipients, where all types of recipients receive multiple forms of outreach.

FTA coordinates evaluation activities with regional staff for situational awareness and to provide regional perspectives on grant activities. Regional staff interviews can corroborate and supply additional interpretation to TrAMS data integrity.

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[94] TrAMS at https://www.transit.dot.gov/funding/grantee-resources/teamtrams/transit-award-management-system-trams.

STRATEGIC GOAL: CLIMATE & SUSTAINABILITY

The Climate & Sustainability section highlights evidence building that helps tackle the climate crisis through substantial reductions in greenhouse gas emissions and transportation-related pollution, and through building more resilient and sustainable transportation systems to benefit and protect communities. This section contains five Climate and Sustainability topic areas with priority questions nested underneath. It updates and expands on the Reducing Transportation Greenhouse Gas Emissions topic from the Learning Agenda: FY 20220-2026. It also introduces four new topic areas on Climate Adaption and Resilience Strategies, Sustainable Aviation Fuel, Battery Transportation and Safe Disposal, and Adoption Barriers to EV Market Penetration. By addressing these priority questions, DOT will fill crucial evidence gaps that it will use to inform policy, regulatory, and operational decisions.

Reducing Transportation Greenhouse Gas Emissions

Priority Questions

- Which DOT strategies are projected to have the largest impact on reducing transportation GHG emissions?
- What are reasonable short term reduction targets for the transportation sector to support the economy targets?

Background

Transportation is the largest source of greenhouse gas (GHG) emissions in the United States, accounting for 29% of total emissions in CY 2021.[95] The Biden-Harris administration has announced an economy-wide goal of net-zero U.S. GHG emissions by CY 2050, with 50 to 52% reductions by CY 2030 (compared to CY 2005 levels). To meet the President's goal and tackle the climate crisis, a comprehensive decarbonization strategy for the entire transportation sector across all modes is needed, including both DOT-specific authorities and other stakeholders in the transportation sector.

The DOT Climate Change Center will coordinate with Federal partners to develop a whole-of-government approach to reducing transportation-related emissions. The DOT Climate Change Center seeks to use evidence to develop GHG reduction strategies and will continually build evidence to support GHG reduction actions.

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[95] U.S. EPA (2023) "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021 – Data Highlights," https://www.epa.gov/system/files/documents/2023-04/Data-Highlights-1990-2021.pdf.

Operating Administration
Office of the Under Secretary for Transportation Policy (OST-P)

Alignment with DOT Strategic Plan
• Strategic Goal: Climate and Sustainability   • Strategic Objective: Path to Economy-Wide Net-Zero Emissions by 2050

Alignment: Other Guiding Documents
• U.S. National Blueprint for Transportation Decarbonization • DOT Research, Development, and Technology Strategic Plan for FY 2022-2026 and the Annual Modal Research Plans

Evidence Building Plan

Recently Completed Evidence-Building Activities
In January 2023, the U.S. Department of Transportation, the Department of Energy, the Environmental Protection Agency, and the U.S. Department of Housing and Urban Development released the U.S. National Blueprint for Transportation Decarbonization.[96] The *Decarbonization Blueprint* provides a framework to transition to a net-zero GHG transportation system that also improves safety, equity, and affordability. It includes three groups of strategies: increasing convenience by making it practical to take fewer or shorter trips, improving efficiency, and transitioning to clean options. During calendar year (CY) 2023, all DOT Operating Administrations produced modal-specific action plans that identified clear, feasible actions that each Operating Administration will take to reduce emissions and reach key domestic milestones in the short (CY 2026), medium (CY 2040), and long term (CY 2050). The DOT Climate Change Center supported development of these strategies, which are internal documents. The action plans generally included qualitative discussions of the impact of Operating Administration actions on GHG emissions, as it is analytically challenging to estimate the impacts without numerous assumptions and modeling capabilities geared toward evaluating federal grant programs and other actions.

Planned Evidence-Building Activities
In 2024, DOT, along with partner agencies, will release public facing action plans outlining actions the federal agencies will take to implement the Blueprint. Additionally, DOT is currently working with DOE and its national labs on a $3 million, three-year project to develop analyses of the impacts of different strategies from the *U.S. National Blueprint for Transportation Decarbonization* on transportation GHG emissions. The project began in 2024 and will be completed in 2027. It will help answer the priority questions of what DOT strategies are projected to be most effective and what would be reasonable GHG reduction targets for transportation.

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[96] DOT, DOE, EPA, HUD (2023), *U.S. National Blueprint for Transportation Decarbonization,* https://www.transportation.gov/priorities/climate-and-sustainability/us-national-blueprint-transportation-decarbonization

Known or Potential Data

The Department of Energy National Labs study is using data from the Environmental Protection Agency's Inventory of U.S. Greenhouse Gas and Emissions and Sinks, Department of Energy studies, and peer reviewed literature. It is pairing multiple economic, energy, and transportation models (POLARIS, GEMS, and TEMPO) to deliver analysis. It is conducting detailed analyses at the local level and scaling them up to the national level by using urban typologies to aggregate projected impacts across areas with similar land use and transportation systems. The modeling allows DOT, in partnership with DOE, to test multiple policy scenarios.

In addition, DOT is supporting GHG analysis at the state and local level by supporting upgrades to the VisionEval scenario planning tool and the CMAQ Toolkit, which provide estimates of the impacts of transportation policies and projects on GHG emissions.

Anticipated Challenges and Mitigation Strategies

Potential challenges for emissions modeling include:

- Data gaps at the modal level of detail
- Modeling capability limitations
- Projecting future mobility trends and potentially disruptive technologies

In 2022 and 2023, DOT faced all of these challenges. To mitigate them and ensure that the best possible data and real-world inputs inform modeling and analysis, the DOT Climate Change Center is coordinating with climate and data experts within DOT and Federal and university partners. In 2024, DOT partnered with DOE National Labs to conduct the type of analyses it was not able to conduct on its own.

Climate Adaptation and Resilience Strategies

Priority Questions

Which climate adaptation and resilience strategies are projected to be most effective in protecting transportation assets?

Background

Climate change presents a significant and growing risk to the safety, effectiveness, equity and sustainability of transportation infrastructure and the communities it serves. Adaptation strategies to address natural hazards exacerbated by climate change are critical to ensure a resilient transportation system. Adaptation strategies may include nature-based solutions, reinforcing locations, elevating infrastructure, and more. Inventorying, monitoring, and evaluating these strategies will enable DOT to measure and compile consistent resilience metrics to ensure that future projects are as cost effective and resilient as possible.

In June 2024 DOT released the 2024-2027 Climate Adaptation Plan (CAP) in accordance with Section 211 of Executive Order 14008.[97] It builds on DOT's 2012 and 2014 Climate Adaption Plans and its Climate Action Plan: Revitalizing Efforts to Bolster Adaptation and Increase Resilience from 2021.[98] To meet the President's goal and tackle the climate crisis, the 2024-2027 CAP directs each Operating Administration within DOT to develop individual Climate Adaptation Plans to address climate risks relevant to their mission-critical activities. In addition, the Department will support continued investments in climate-smart transportation infrastructure and incorporate natural hazard and climate risk information into federal property management decisions.

Through its Climate Adaptation Plan, the Department is also able to advance environmental justice as part of its mission, consistent with Executive Orders 14008 and 14096.[99] As the Department implements its Climate Adaptation Plan the agency will use its best efforts, as appropriate and consistent with applicable law, to: (1) address disproportionate and adverse environmental and health effects (including risks) and hazards, including those related to climate change and cumulative impacts of environmental and other burdens on communities with environmental justice concerns; and, (2) provide opportunities for the meaningful engagement of persons and communities with environmental justice concerns.

Operating Administration

All Operating Administrations

Alignment with DOT Strategic Plan

- Strategic Goal: Economic Strength and Global Competitiveness
- Strategic Goal: Equity
  - Strategic Objectives:
    - Proactive Intervention
    - Planning and Capacity building

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[97] DOT (2024) *2024-2027 Climate Adaption Plan*, https://www.sustainability.gov/pdfs/dot-2024-cap.pdf; "Executive Order 14008 of January 27, 2021, Tackling the Climate Crisis at Home and Abroad," Code of Federal Regulations, 86 FR 7619, https://www.federalregister.gov/documents/2021/02/01/2021-02177/tackling-the-climate-crisis-at-home-and-abroad

[98] DOT (2021) *Climate Action Plan: Revitalizing Efforts to Bolster Adaption and Increase Resilience*, https://www.transportation.gov/sites/dot.gov/files/2021-10/Climate_Action_Plan.pdf.

[99] "Executive Order 14096 of April 21, 2023, Revitalizing our Nation's Commitment to Environmental Justice for All," Code of Federal Regulations, 88 FR 25251: 25251-25621, https://www.federalregister.gov/documents/2023/04/26/2023-08955/revitalizing-our-nations-commitment-to-environmental-justice-for-all

- Strategic Goal: Climate and Sustainability
    - Strategic Objectives:
        - Infrastructure Resilience
        - Climate Justice & Environmental Justice

Alignment: Other Guiding Documents

- DOT Climate Action Plan
- DOT Equity Action Plan
- U.S. National Blueprint for Transportation Decarbonization
- National Roadway Safety Strategy and activities in the Progress Report
- DOT Research, Development, and Technology Strategic Plan for FY 2022-2026 and the Annual Modal Research Plans
- National Climate Resilience Framework
- Advancing Climate Resilience through Climate-Smart Infrastructure Investments and Implementation Guidance for the Disaster Resiliency Planning Act [100]
- U.S. Aviation Climate Action Plan
- Executive Order 14008 Tackling the Climate Crisis at Home and Abroad
- Executive Order 14096 Revitalizing Our Nation's Commitment to Environmental Justice for All
- DOT FY 2025 Evaluation Plan

Evidence Building Plan

Recently Completed Evidence-Building Activities

The Federal Highway Administration (FHWA) is strengthening the evidence base on climate adaption and resilience strategies through its work on the Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) program. First, FHWA is complying with 23 U.S.C. §176(f), by establishing metrics for the purpose of evaluating the effectiveness and impacts of PROTECT Discretionary Grant Program-funded projects and procedures for monitoring and evaluating projects based on those metrics. In March 2024 FHWA published a notice in the *Federal Register* requesting public comment.[101] Second, FHWA is initiating an evaluation of the PROTECT program, as described in the DOT FY 2025 Evaluation Plan.

Planned Evidence-Building Activities

In CY 2025, all DOT Operating Administrations will submit proposed adaptation and resilience strategies to be included in their climate adaptation plans to the DOT Climate Change Center. The DOT Climate Change Center will review evidence-building priorities submitted by Operating Administrations to assess the effectiveness of strategic actions for adaptation and resilience. All submissions require plans to inventory, monitor, and evaluate (IME) these strategies for effectiveness. Submission must also include evidence demonstrating forecasted impact, accounting for vulnerability as determined by the CHER tool for DOT managed assets or similar measure.[102] Through partnerships with the Volpe Center and other Federal partners, Operating Administrations will have the opportunity to work with experts to improve the rigor of their strategies and IME to address natural hazard impacts exacerbated by climate change. The Climate Change Center will coordinate communication of these results within DOT.

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[100] OMB (2023) "M-24-03," https://www.whitehouse.gov/wp-content/uploads/2023/11/M-24-03-Advancing-Climate-Resilience-through-Climate-Smart-Infrastructure-Investments.pdf.

[101] DOT, FHWA (2024) "Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation Discretionary Program Metrics," *Federal Register* (March 21, 2024): Docket No.: FHWA-2023-0002, https://www.federalregister.gov/documents/2024/03/21/2024-05934/promoting-resilient-operations-for-transformative-efficient-and-cost-saving-transportation.

[102] DOT (2023) "DOT Order 4360: Climate Change Adaptation and Resilience Policy for DOT Operational Assets," https://www.transportation.gov/mission/climate-change-adaptation-and-resilience-policy-dot-operational-assets.

Additionally, all final modal climate adaptation plans will include analysis or studies to document the effectiveness of their resilience and adaptation strategies and the impact on adjacent assets and natural and cultural resources.

In support of all activities described above, the Department will strengthen its evidence base by monitoring recent and ongoing transportation adaptation and resilience research conducted by DOT partners, including Federal partners, the Transportation Research Board, colleges and universities, non-profits, and the Volpe Center. This research and information will continue to be shared with DOT offices and modal administrations through the DOT Climate Change Center.

Known or Potential Data

To support inventorying, monitoring, and evaluation, Operating Administrations will utilize data sources that include but are not limited to: Transportation Asset Management Plans, Resilience Improvement Plans, analytical data from IME activities and from partners; and data from other transportation analyses conducted by DOT research partners.

Tools

A program with training for modal administrations to track these results is needed and will be funded by the DOT Climate Change Center.

Methods and Analytical Approaches

A determination of methods, analytic approaches, and metrics to be used to answer the priority question will be part of this evidence-building activity.

Anticipated Challenges and Mitigation Strategies

Potential challenges for adaptation strategies inventory, monitoring and evaluation include:

- Lack of consistent inventories of adaptation strategies
- Monitoring is not a requirement of performance in all types of transportation infrastructure. Evaluation criteria and metrics vary by type of infrastructure and are not routinely implemented for all projects.

To mitigate these challenges, the DOT Climate Change Center will coordinate with climate and data experts within DOT, as well as with Federal and university partners, to ensure that the best possible data and real-world inputs inform inventories, monitoring, evaluation, reporting, and analysis.

Sustainable Aviation Fuel

Priority Questions

What are the environmental benefits and costs of using 100% drop-in sustainable aviation fuel?

Background

To decarbonize the aviation sector, governments and industry are pursuing a basket of measures including new aircraft technology development, operational improvements, and production and use of sustainable aviation fuel (SAF). The United States 2021 Aviation Climate Action Plan recognizes that SAF offers a critical near-term solution to reduce greenhouse gas emissions while enabling rural economic development, domestic energy security, and continued aviation decarbonization in the long-term.[103] The combustion of jet fuel from domestic and international aviation contributes more than 10% of total transportation greenhouse gas emissions in the United States. Developing innovative SAF production technologies will enable the United States to both meet its domestic climate goals and position it as a global leader in the emerging SAF market. The Inflation Reduction Act (IRA) of 2022 created the Sustainable Aviation Fuel Tax Credit (40B).[104] For producers that demonstrate a 50% reduction in lifecycle greenhouse gas emissions, the tax credit is worth $1.25 for each gallon of sustainable aviation fuel in a qualified mix, increasing up to $1.75 for fuels with 100% lifecycle GHG reduction compared to petroleum jet fuels.

SAF is a drop-in liquid hydrocarbon fuel with the same performance and safety as conventional jet fuels produced from petroleum. "Drop-in" alternative fuels can be deployed in existing infrastructure, engines, and aircraft without any modification to engines or other equipment while maintaining an equivalent level of safety and performance to petroleum jet fuels. SAF can be created from renewable or waste materials and has been shown to significantly reduce life-cycle greenhouse gas emissions relative to petroleum jet fuel; if combined with low-carbon technologies they could potentially reduce life-cycle emissions by 100%. Currently, SAF cannot exceed a blend limit of 50% by volume with petroleum jet fuel, although major original equipment manufacturers have committed to eliminating this blend limit by 2030. While the CO_2 emissions impacts of 50% drop-in SAF have been studied, the emissions impacts of 100% drop-in SAF are not yet well understood or quantified.

SAF is the most viable pathway for rapid decarbonization of the aviation sector for two main reasons. First, the majority of CO_2 emissions stem from long-haul operations that are not expected to be replaced with battery electrification and hydrogen fuels in the coming decades. Second, fleet turnover is slow—an average of 30 years for most aircraft—meaning that there is an advantage to reducing the greenhouse gas emissions in the existing aviation fleet.

The Center of Excellence for Alternative Jet Fuels and the Environment, also known as ASCENT, is a cooperative aviation research organization for alternative jet fuels and environment that is co-led by Washington State University and the Massachusetts Institute of Technology. ASCENT is funded by the FAA, NASA, the Department of Defense, Transport Canada, and the Environmental Protection Agency. ASCENT projects support testing and qualification of new fuels, analysis of lifecycle greenhouse gas emissions, optimization of supply chains, quantification of emissions from the combustion of SAF/SAF blends, and assessments of impacts on climate, air quality, and health.

DOT/FAA co-lead the SAF Grand Challenge to support the expansion of SAF production while reducing the cost and enhancing the sustainability. The SAF Grand Challenge is a whole of government approach led by DOT, Department of Energy, and the U.S. Department of Agriculture, which established the goal of increasing the U.S.'s SAF production to at least three billion gallons per year by 2030. The SAF Grand Challenge sets a long-term goal of 35 billion gallons of SAF by 2050. SAF production will also be supported by tax credits and the FAST grant program established by the IRA. FAA will align SAF foundational fact-finding and policy analysis activities in support of the SAF Grand Challenge.

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[103] DOT, FAA (2021) *United States Aviation Climate Action Plan*, https://www.faa.gov/sustainability/aviation-climate-action-plan.
[104] Public Law No. 117-169

The FAA, along with other U.S. Government agencies involved in the SAF Grand Challenge, has identified key metrics to assess progress on the goals of the SAF Grand Challenge. These include: (1) annual SAF production volumes; (2) associated CO_2 emissions reductions (compared to petroleum jet fuel; (3) projections of potential future SAF volumes; and (4) research, development, and deployment projects that enable the production and use of SAF. The SAF Grand Challenge interagency working group will collect data on the key metrics to track progress on a regular (semi-annual/annual) basis. The data will be evaluated in terms of meeting the domestic production goals of the SAF Grand Challenge.

The FAA launched the Fueling Aviation Sustainable Transition (FAST) discretionary grant program created by the Inflation Reduction Act. The grant program will provide $244.5 million to make investments to accelerate the production and use of SAF and $46.5 million for the development of low-emission aviation technologies to support the U.S. aviation climate goal to achieve net-zero GHG emissions by 2050. FAST will support the build-out of infrastructure projects related to SAF production, transportation, blending, and storage, while also supporting scoping studies related to infrastructure needs for SAF. FAST complements existing FAA research and development on energy and technology and operations.[105]

Operating Administration

Federal Aviation Administration (FAA)
Under Secretary for Transportation Policy, Office of Aviation and International Affairs (OST-X)

Alignment with DOT Strategic Plan

- Strategic Goal: Economic Strength and Global Competitiveness
- Strategic Goal: Climate and Sustainability
  - Strategic Objective: Path to Economy-Wide Net-Zero Emissions by 2050

Alignment: Other Guiding Documents

- U.S. Aviation Climate Action Plan
- SAF Grand Challenge Roadmap
- Sustainable National Flight Partnership
- U.S. National Blueprint for Transportation Decarbonization
- DOT Research, Development, and Technology Strategic Plan for FY 2022-2026 and the Annual Modal Research Plans
- DOT FY 2025 Evaluation Plan

Evidence Building Plan

Recently Completed Evidence-Building Activities

ASCENT supports foundational fact-finding and policy analysis to promote the production and use of SAF.

Through ASCENT, the FAA and its partners:

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[105] For more information, see https://www.faa.gov/about/officeorg/headquartersoffices/apl/aee/energy and https://www.faa.gov/about/office_org/headquarters_offices/apl/aee/technology_operations.

- Develop testing data and analysis to support qualification of additional SAF pathways, which specifies a combination of fuel feedstock and production process, as well as higher blend levels of SAF with ASTM International, to create consensus international standards. This work is accomplished through the SAF clearinghouse, hosted by the University of Dayton Research Institute;

- Analyze existing and proposed SAF public policies and public incentives on the economics of SAF production using techno-economic tools;

- Track and estimate SAF availability and environmental benefits to inform policymakers through data gathering on actual and announced production, modeling of future fuel production, and lifecycle greenhouse gas emissions analysis.

The FAA, along with other U.S. Government agencies involved in the SAF Grand Challenge, is addressing critical barriers, including efficient evaluation of fuel engine and aircraft performance and safety, advancement of certification and qualification processes, expansion of existing blend limits, and integration of SAF into fuel distribution infrastructure. Specifically, the FAA is developing specifications for 100% SAF, both in neat form and blended with other SAF, to enable additional opportunities for fuel producers and suppliers to simplify distribution logistics and reduce risk along the supply chain.

Planned Evidence-Building Activities

The FAA will continue to track progress on the following efforts to assess and quantify the environmental benefits and costs of using 100% drop-in SAF:

- ASCENT Center of Excellence will:
    - Assess and understand the impact of fuel composition on combustion emissions and related environmental impacts
    - Investigate material compatibility and performance of novel fuels
- SAF Grand Challenge will perform a cost-benefit analysis of 100% drop-in SAF

Known or Potential Data

The FAA will use the data that it collects through the ASCENT Center of Excellence to understand the current and potential landscape of petroleum jet fuel and sustainable aviation fuels. This data will help aviation stakeholders and enable further SAF development and deployment. The data to be collected includes physical characteristics and chemical composition of fuels, which are important factors because SAF must blended into conventional jet fuel (up to a maximum of 50%) to meet specification requirements and material compatibility. The composition of the blended fuel is relevant to assess impacts related to air quality and health. Information and data on techno-economic analyses, lifecycle assessments, and supply chain optimization are also being gathered to estimate SAF production volumes and the associated CO_2 emissions reductions. This information will help inform climate impact assessments.

Tools

ASCENT supports projects to develop tools related to techno-economic analysis, lifecycle assessment, and supply chain optimization for SAF.

Current ASCENT projects, in collaboration with the DOT Volpe Transportation Center, maintain, develop and update current tools such as the Aviation Environmental Design Tool (AEDT) and the Freight and Fuel Transportation and Optimization Tool (FTOT).

AEDT is a software system that models aircraft performance in space and time to estimate fuel consumption, emissions, noise, and air quality consequences. FTOT is a flexible scenario-testing tool that optimizes the transportation of materials for energy and freight scenarios. The tool is designed to analyze the transportation needs and constraints associated with material collection, processing, and distribution to provide an optimal solution to supply chain routing and flows.

Methods and Analytical Approaches

The FAA will use tools and analytic methods developed through ASCENT to develop 100% drop-in SAF and assess the associated environmental impacts. Specifically, the lifecycle greenhouse gas emissions calculation methods, techno-economic analysis to estimate costs associated with SAF facilities, material compatibility tests, and emissions measurement and quantification.

Anticipated Challenges and Mitigation Strategies

As with any model, the data input quality is crucial to the result it produces. Reliable data, such as for refinery output and operational status, can be difficult to acquire. Hiring personnel with technical and relevant skill sets is also challenges. Attracting and retaining sufficient staff with appropriate expertise to develop and manage programs, support domestic and international policy efforts, and coordinate with other agencies is difficult given significant private sector demand for these capabilities.

A mitigation strategy employed is to effectively communicate progress of current efforts and challenges and barriers with key stakeholders. This communication ensures that problems are identified early on, and appropriate actions and risk mitigation strategies can be employed. The models used for SAF supply chain analyses include details for various SAF pathways that include feedstock quantity and price and associated processing technologies. The inputs to the model are reviewed frequently and updated as new information becomes available.

Photo Credit: Getty Images

Battery Transportation and Safe Disposal

Priority Questions

Which technologies have been shown to effectively improve the safety of shipping lithium-ion batteries (including batteries ranging from small scale batteries used in consumer electronics to large scale batteries used in electric vehicles) from new batteries to end of life?

- Which existing or new technologies have been shown to efficiently and cost effectively measure (for the purposes of enforcement) a battery's state-of-charge, and at what margin of error?
- To what extent would the addition of early-warning sensors in battery packaging affect the risk of death or injury from battery incidents?
- To what degree would integration of sensors and fire protection into battery packaging affect safety outcomes?
- To what extent is existing packaging effective at preventing death/injury from lithium-ion battery incidents?
- To what extent do the safety performance characteristics of emerging battery types differ from lithium-ion batteries?
- What methods to de-energize end-of-life or damaged batteries have been shown to be safe and cost effective?

Background

The Pipeline and Hazardous Materials Safety Administration (PHMSA) is responsible for the safe transportation of hazardous materials. This includes everything from fireworks to common household cleaners. Areas along the battery transport chain such as packaging, battery classification, marking/hazard communication, and emergency response are also in PHMSA's purview. It is critical to understand how rapidly developing battery technologies impact transportation safety, as it can affect use and uptake of new technologies.

As the push to decarbonization intensifies, there is a corresponding increase in demand for lithium batteries for use in electric vehicles, micro-mobility, and energy storage. PHMSA needs to better understand the safety of battery use and transportation and determine requisite policy and operation actions to ensure a smooth path to electrification.

Though lithium batteries are critical for a decarbonized future, they also pose risks of injury and death due to battery fires. The risks posed by lithium cells and batteries are generally a function of type, size, and chemistry. Lithium cells and batteries can present both chemical (e.g., corrosive or flammable electrolytes) and electrical hazards.

Unlike standard alkaline batteries, most lithium batteries manufactured today contain a flammable electrolyte and have an incredibly high energy density. They can overheat and ignite under certain conditions, such as a short circuit, physical damage, improper design, or assembly. Once ignited, lithium cell and battery fires can be difficult to extinguish. In rare cases lithium cells and batteries can experience thermal runaway, a chain reaction leading to a violent release of stored energy and flammable gas. This thermal runaway can propagate to other batteries or combustible materials nearby, potentially resulting in large scale thermal events with severe consequences.

Operating Administration

Pipeline and Hazardous Materials Safety Administration (PHMSA)

Alignment with DOT Strategic Plan

- Strategic Goal: Safety
    - Strategic Objectives:
        - Safe Public
        - Safe Design
- Strategic Goal: Economic Strength and Global Competitiveness
    - Strategic Objective: Resilient Supply Chains
- Strategic Goal: Climate and Sustainability

Alignment: Other Guiding Documents

DOT Research, Development, and Technology Strategic Plan for FY 2022-2026 and the Annual Modal Research Plans

Evidence Building Plan

Recently Completed Evidence-Building Activities

PHMSA activities related to the priority question are mostly in foundational fact finding to gain foundational understanding that guides policy and operational decision-making.

Battery Logistics Integrated Safety System (BLISS) (FY 2022-present): This project is developing "smart" packaging that integrates sensors into battery packaging of different form factors. The packaging monitors, detects, notifies, and communicates any failure of the batteries within so that first responders get an early warning of battery incidents. The project is developing an EV blanket, truck trailer, hand-held case, and 55-gallon drum to address different battery transport/use applications such as EV's aboard roll-on roll-off vessels, e-bike charging, or batteries getting transported to recycling facilities. This project helps answer the question of whether existing packaging is adequate in preventing death/injury from battery incidents.

De-Energized Lithium-ion Batteries (FY 2021-present): This project identifies methodologies to safely de-energize lithium-ion batteries to enable the safe shipment of aged/defective lithium-ion batteries to recycling centers via highway, railway, and maritime vessel. This project conducts market research as well as in-house development of technology to de-energize lithium-ion batteries.

Sodium-ion Batteries (FY 2023-present): This project studies an emerging battery type that is being sold on the market as an alternative to lithium-ion batteries. The level of safety of these batteries will be compared to traditional lithium-ion batteries. This helps answer questions around classification of battery hazards in regulations and whether guidelines need to be updated based on findings from this study.

State-of-Charge Sensor for Lithium Batteries (FY 2023-2024): The goal of this SBIR project was to have a company develop a standalone field-portable lithium battery monitoring device that could measure state-of-charge, state-of-health, or presence of defects. Current regulations require that batteries shipped by air must be 30% state-of-charge or lower, with no readily available method of checking state-of-charge.[106] This project is meant to fill that gap and help PHMSA understand practical requirements of implementing state-of-charge guidelines for battery shipments. Currently under evaluation for Phase II funding.

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[106] 49 CFR § 172.102

Planned Evidence-Building Activities

PHMSA will investigate transportation-related abuse for lithium batteries to further understand the packaging protection necessary to prevent death/injury from battery incidents. The project will examine technical factors that contribute to battery incidents. Specific activities planned include research on the factors that contribute to end-of-life and damaged/defective battery incidents enroute to recycling facilities.

To better understand the risks of lithium-ion batteries, PHMSA is developing a cooperative study with a Federal partner to study the risks of long-term battery storage on lithium-ion batteries. This project will help PHMSA gain understanding of battery levels of safety when stored under different conditions such as reduced state-of-charge at different temperatures.

Known or Potential Data

- Packaging performance data comparing failure of improved packaging to traditional packaging
- Safety/performance data of emerging battery types
- Data on existing methods of de-energizing end-of-life batteries
- Existing/ ongoing from FAA: Data on state-of-charge of batteries shipped by air

Tools

PHMSA will be exploring this priority question through research contracts and agreements. Some of the contracts will utilize tools and resources at other federal facilities through inter agency agreements and some will utilize the innovation of small businesses through the Small Business Innovation Research program.

Methods and Analytical Approaches

- Packaging testing includes burn tests to test package integrity as well as testing sensor response to elevated temperature and gas releases
- Battery safety test methods include accelerating rate calorimetry to understand temperature behavior of batteries, aging behaviors, off-gas analysis, mechanical abuse tests, and electrochemical performance.

Anticipated Challenges and Mitigation Strategies

Challenges include a rapidly changing battery technology landscape and limited resources to conduct research that can agilely and proactively respond to this landscape. PHMSA aims to conduct proactive and forward-looking research to anticipate safety risks and mitigation strategies. As PHMSA research can be resource constrained with limited funds to go to a limited number of research projects, PHMSA will target high impact and high priority research.

Adoption Barriers to Electric Vehicle (EV) Market Penetration

Priority Questions

EV Chargers
- What is the usage level of electric vehicles (EVs)?
- How are EVs used in the U.S.?
- What are the charging patterns of the EVs?

EV Ownership
- What are the characteristics (demographics or business type) of EV owners?
- What is the effectiveness of various incentive efforts?

Barriers to EV Adoption
- What are the barriers to EV market penetration and usage in the U.S.?
- How do barriers compare to each other with respect to the decision of owning an EV? For example, is range anxiety more a barrier to owning an EV than the availability of charging station? Is EV cost a greater barrier than range anxiety?
- To what degree do barriers to EV market penetration and usage vary by type of owner (individual vs. business), socioeconomic and demographic characteristics, and EV charging infrastructure?

Background

Although there is a long way to go to reach the goal of a 50 percent EV share of new vehicle sales in 2030 from 9 percent in 2023, U.S. electric vehicle (EV) sales are growing rapidly. EVs and hybrids surpassed 16 percent of total 2023 U.S. light-duty vehicle sales.[107] In June 2024, 133,533 hybrid electric vehicles (40,726 cars and 92,807 light trucks) were sold in the United States, up 32.5% from the sales in June 2023.[108] A total of 120,314 plug-in vehicles (96,666 battery electric vehicles and 23,648 plug-in hybrid electric vehicles) were sold during June 2024 in the United States, down 3.8% from the sales in June 2023. Information is needed on who is purchasing and who is not purchasing these vehicles, and how EV owners charge their vehicles.

A study of California drivers found that EV owners do 80 to 90 percent of their charging at home, a major departure from traditional vehicle petroleum refueling.[109] In mid-2023, 55,829 public charging stations with two to three charging ports per station were in operation in the U.S. Of these, 7,908 with a total of 33,375 charging ports, were DC fast charging stations (DCFC), capable of recharging an EV up to 80 percent of capacity in 15 to 45 minutes.[110] To date, 1,911 DCFC stations with 21,039 ports are proprietary to one manufacturer's vehicles. At present, coverage of the National Highway System for intercity EV charging is concentrated in a few states, with large portions of the Nation's midsection sparsely covered. This compares with approximately 142,000 gasoline stations, typically with 8 pumps per station, for refueling Internal Combustible Engine (ICEs) in about six minutes for a full refill.[111] The availability and location of DCFC chargers have the potential to impact the decision to own an EV. L1 and L2 are mainly for local trips. The impact of shortage of DCFC stations on adoption becomes critical in a long-distance trip concept. If people are concerned about being able to recharge enroute when commuting or taking any trip other than a short local trip, they are less likely to purchase an EV.

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[107] U.S. Energy Information Administration (2024) "In-Brief Analysis: Electric Vehicles and Hybrids Surpass 16% of Total 2023 U.S. Light-Duty Vehicle Sales," *Today in Energy*, https://www.eia.gov/todayinenergy/detail.php?id=61344.

[108] Argonne National Laboratory (2024), "Light Duty Electric Drive Vehicles Monthly Sales Updates," https://www.anl.gov/esia/light-duty-electric-drive-vehicles-monthly-sales-updates

[109] D. Greene, E. Kontou et al (2020) "Public Charging Infrastructure for Electric Vehicles: What Is It Worth?" *Transportation Research Part D: Transport and Environment*, 78:102182, https://doi.org/10.1016/j.trd.2019.11.011.

[110] U.S. DOE, Alternative Fuels Data Center (AFDC), https://afdc.energy.gov.

[111] S. Davis and R. Boundy (2022) *Transportation Energy Data Book: Edition 40*, (Oak Ridge, TN: Oak Ridge National Laboratory), https://tedb.ornl.gov/data/.

A strong understanding by DOT of the EV market penetration barriers in the U.S. and how significant each of these barriers is in limiting market penetration is imperative for DOT to successfully support expanding the EV market. Because of the rapidly changing EV landscape, it is important to have newer data to understand recent trends. An expanded EV market will help lower greenhouse gas (GHS) emissions and improve air quality. A typical 200-mile range all-electric vehicle sold in the U.S. today uses about half as much energy and emits about half as much CO_2 as a comparable gasoline-powered vehicle.[112] DOT seeks to develop evidence that can be used to inform decisions on EV infrastructure investments, allow decision makers to prioritize strategies to overcome the barriers, and determine the effectiveness of policies and programs in providing maximum reach and impact of EVs in the U.S. vehicle fleet This evidence will be valuable to planning decisions related to transportation systems, infrastructure investments, and automobile manufacturing. It is also needed to understand the equity effects of the transition to electrified transportation and effectiveness of policy levers.

Operating Administration

Federal Highway Administration (FHWA)

Joint Office of Energy and Transportation (JOET)

Bureau of Transportation Statistics (BTS)

Alignment with DOT Strategic Plan

- Strategic Goal: Economic Strength and Global Competitiveness
    - Strategic Objective: Path to Economy-Wide Net-Zero Emissions by 2050
- Strategic Goal: Equity
- Strategic Goal: Climate and Sustainability
- Strategic Goal: Transformation

Alignment: Other Guiding Documents

- U.S. National Blueprint for Transportation Decarbonization
- DOT Research, Development, and Technology Strategic Plan for FY 2022-2026 and the Annual Modal Research Plans

Evidence Building Plan

Recently Completed Evidence-Building Activities

The Bureau of Transportation Statistics (BTS)'s Electric Vehicle Inventory and Usage Survey (eVIUS) will collect data on EV usage and charging patterns as well as EV-owner demographics and charging behavior. It will collect information on acquisition, ownership, and usage by households at all income levels. BTS anticipates the eVIUS data collection to start in October 2024 and for the data collection to be completed by the end of January 2025. The data is planned to be released in Spring 2025.

The Joint Office of Energy and Transportation's website (https://driveelectric.gov/) includes a suite of EV related data and tools such as the locations of installed chargers and designated corridors. Pursuant to 23 CFR 680.112, States and other direct recipients are required to submit data such as charging station identifier, charging port identifier, energy (kWh) dispensed to EVs per charging session by port. Established by the Joint Office, Electric Vehicle Charging Analytics and Reporting Tool (EV-ChART) is a web-based data portal and analytics platform for organizations to report their charging station data for the federally-funded charging stations subject to 23 CFR 680 and for members of the public to access this data.

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[112] DOT, BTS (2023) *Transportation Statistics Annual Report 2023.*

Planned Evidence-Building Activities

BTS is considering developing a second phase of eVIUS to address priority questions 5 through 10. The second phase would potentially cover a wider vehicle population to understand the barriers to EV uses and market penetration and their comparative significance over time.

To facilitate the design of the second phase, BTS would consider conducting focus groups to understand motivators for individuals and businesses to purchase an EV and barriers and disincentives for individuals and businesses for owning an EV. The schedule for these activities could be as follows:

- Plan, design, and prepare for data collection (12 months)
- Data collection (3 months)
- Post processing and publication (5 months)

Known or Potential Data

The phase one eVIUS data will be analyzed to answer above-mentioned priority questions 1 through 4.

For priority questions 5 to 10, BTS may develop a second phase of the eVIUS (described above). In addition, BTS could use data from the EV-ChART. BTS may be able to leverage proprietary data on barriers to EV adoption through the Joint Office of Energy and Transportation.

Vehicle registration data is an invaluable source of administration records where EV registration data can be used to monitor EV market penetration over time. Continual monitoring EV registrations will also enable BTS to estimate vehicle scrappage rate of all vehicles (including EVs), which is crucial evidence to understand EV market penetration. Currently, the access to vehicle registration data is restricted and commercially available.

Analyses of DOT formula and discretionary funding obligation and expenditure rates for EV to the Joint Office of Energy and Transportation can be used to understanding the significance of planning and construction barriers in building and scaling up EV infrastructure in relationship to the barriers encountered with traditional transportation construction products.

Tools

Currently, the data/tools are extremely limited at the national level. BTS is considering approaches to fulfilling these gaps, including:

- Expanding the eVIUS to a regular recurring data collection to collect data on barriers and adoption over time
- Analyzing data in EV-ChART
- Conducting the feasibility study to establish a national vehicle registration database

Methods and Analytical Approaches

BTS will soon be conducting the first national-level Electric Vehicle Inventory and Use Survey (eVIUS) to collect data on EV usage and charging behaviors of EV owners. BTS will use the combination of eVIUS data and geospatial data of EV-charging infrastructure to understand clustering and disparities by geographies. This will help understand and identify barriers related to charging patterns, demographics of EV owners, housing and land use characteristics, and geographic distribution.

DOT could analyze the Department's formula and discretionary funding obligation and expenditure rates for EV. This will assist in understanding the significance of planning and construction barriers in building and scaling up EV infrastructure in relationship to the barriers encountered with traditional transportation construction products.

Anticipated Challenges and Mitigation Strategies

The data/tools are extremely limited at the national level. Lack of data is the biggest challenge in addressing the priority questions. Data-related challenges include:

- Currently, national statistics do not exist on EV use and charging behavior of EV owners. This makes it difficult to understand EVs' contribution to meeting the 2050 zero-emission goal.

- Much is unknown about the current barriers to adoption of EVs, which limits the data available to decision-makers when considering investments related to EVs and charging infrastructure.

- Vehicle registration data serve multiple purposes in building evidence and are only available from third-party entities through costly acquisitions. Furthermore, if a State chooses to not grant permission to use, comprehensive and consistent vehicle registration data from all U.S. states will not be available to build evidence that is needed to inform policy and operational decisions. Specifically, this presents a challenge to obtain a complete and accurate frame for survey design and sample selection – resulting in incomplete and biased national-level estimates. A national vehicle registration database, currently non-existent, would overcome the challenge.

In the short term, BTS will explore inter-agency partnerships to address the data gaps. In the mid-term, DOT could consider proposing changes to BTS statues under 49 U.S.C. §63 to provide BTS explicit authority to establish and collect comprehensive and consistent vehicle registration data from all States.

Photo Credit: Getty Images

STRATEGIC GOAL: TRANSFORMATION

The Transformation section spotlights evidence building activities that design for the future. This section contains one Transformation topic area on the Safe Integration of Advanced Air Mobility with five priority questions nested underneath. By addressing these five priority questions, DOT will fill important Transformation evidence gaps that will be used to inform policy, operational, and regulatory decisions.

Safe Integration of Advanced Air Mobility

Priority Questions

- What do initial Advanced Air Mobility (AAM) operations look like at an early adopter location?
- What regulatory/policy changes would be most effective at facilitating AAM implementation?
- What infrastructure changes will AAM electric vertical takeoff and landing (eVTOL) aircraft operations require?
- How and to what extent does do existing regulations and policies inhibit the implementation of cooperative Urban Air Mobility (UAM) operations in the National Airspace System (NAS)?
- What data and testing will be needed to support operational, regulatory, and policy changes that allow for the safe incorporation of AAM operations into the NAS?

Background

Advanced Air Mobility (AAM) is an emerging aviation ecosystem that leverages new aircraft and an array of innovative technologies to provide the opportunity for more efficient, sustainable, and equitable options for transportation. AAM is an umbrella term for aircraft that are likely highly automated and electric, and they are often referred to as air taxis or electric Vertical Takeoff and Landing (eVTOL) aircraft. Many of these new aircraft have the ability to take off vertically like a helicopter and transition into horizontal flight like a traditional airplane, and then transition back to vertical flight for landing. AAM aircraft could be used to transport cargo and/or passengers.

The Federal Aviation Administration (FAA) has a long, successful history of bringing new technologies safely into aviation. The agency's role in integrating AAM into the National Airspace System (NAS) is to ensure this new generation of aircraft maintains the highest level of operational safety that defines commercial aviation today. The FAA's top priority and statutory responsibility are to ensure the safety of the traveling public. The agency is looking at every necessary aspect to support AAM flights, including the aircraft itself, the framework for operations, access to the airspace, operator training, infrastructure development, environmental impacts, and community engagement.

As aircraft are developed, the FAA will amend, as appropriate, operational rules and pilot training requirements. In the longer term, the agency will develop permanent regulations to safely enable powered lift operations and pilot training and certification.

The FAA is implementing a crawl-walk-run methodology that recognizes early opportunities to support initial operations through existing services and infrastructure or with minimal changes where possible. The agency is doing this while developing a path to implementation of more advanced concepts and capabilities to support increasing scale and automation of AAM operations, as well as integration with other types of aircraft operating in the NAS.

To help support various AAM activities and help enable near-term operations, the FAA created Innovate28 (I28), a joint government and industry initiative that will culminate in integrated AAM operations at one or more key site locations by 2028.

The FAA also recognizes a need to execute collaborative industry and government actions in order to mature AAM concepts, operations, and regulatory frameworks needed in the medium to long term. These collaborative efforts will require a framework where aircraft operators communicate with each other and third-party service providers. That information will also be available to the FAA. This framework is currently being developed through research efforts that support the Urban Air Mobility (UAM) Concept of Operations document which outlines the mature state of AAM operations when a high volume of aircraft are operating and advanced air traffic systems are required. This document envisions a collaborative environment facilitated by extensive data sharing among interconnected third-party systems.

Operating Administration

Federal Aviation Administration (FAA)

Alignment with DOT Strategic Plan

- Strategic Goal: Transformation
  - Strategic Objectives:
    - Experimentation
    - Flexibility and Adaptability
- Strategic Goal: Safety
  - Strategic Objectives:
    - Safe Public
    - Safe Systems

Alignment: Other Guiding Documents

- Advanced Air Mobility (AAM) Implementation Plan
- Urban Air Mobility (UAM) Concept of Operations 2.0
- DOT Research, Development, and Technology Strategic Plan for FY 2022-2026 and the Annual Modal Research Plans
- DOT FY 2025 Evaluation Plan

Evidence Building Plan
Recently Completed Evidence-Building Activities

Innovate28 (I28) (FY 2023–FY 2028)

I28 is the main ongoing activity the FAA is participating in for AAM. It aims to help facilitate the integration of initial AAM operations at one or more key site location by 2028. I28 published the AAM Implementation Plan in July 2023. It is a living document that will guide implementation efforts and mature as the FAA works with stakeholders to refine and execute AAM implementation strategies. Version 1.0 specifically addresses initial entry into service operations, workstreams, and tools for tracking the milestones of internal and external stakeholders.[113]

The FAA is also working with industry to gather data about aircraft performance and operational plans. The FAA also works with airports and local stakeholders to determine their plans for AAM operations. Once this data is collected, it is then used to perform Airspace Integration Assessments using modeling and simulation. These activities assess the ability for a specific airport to safely support the proposed AAM operations. The I28 program also uses this data to help inform the rulemaking process.

The FAA will also utilize modeling and simulation capabilities including fast-time simulations and Human-in-the-Loop (HITL) simulations in which simulated AAM traffic is injected in models of existing operations in order to understand the impacts of AAM operations in targeted environments. These analyses will inform feasibility of local AAM operations

Interagency Working Group (IWG) (FY 2023–FY 2024)

Passed in October 2022, the Advanced Air Mobility Coordination and Leadership Act mandates the development of an interagency working group led by the DOT to formulate a comprehensive national strategy for AAM by 2024. This involves organizing interagency personnel into subgroups to focus on specific areas (infrastructure development, security, automation, community roles, and air traffic federation) that are key to safely integrating AAM operations into the NAS. These subgroups then collect data and develop strategies to solve the issues present in their area of expertise. The results of these subgroups then inform the national strategy for AAM implementation which is under development.

The National Strategy will include recommendations which are aimed at guiding the transition of AAM from its initial stages to more advanced levels, thereby maximizing its societal benefits. It will also include a detailed plan that outlines the roles and responsibilities of each Federal department and agency and define the involvement of State, local, and Tribal governments in this process.

To comply with the FAA Reauthorization Act of 2024, the interagency working group will include the identification of government efficiencies that could impact the potential implementation of AAM, as well as electric infrastructure challenges and needs in the National Strategy.[114] Also, the working group will consult additional industry members as part of the document review process to help the working group understand potential barriers to entry. Ultimately, this plan will be used by the many government agencies involved in helping facilitate AAM integration in the United States.

Autonomy Working Group (AWG) Phase I (FY 2023–FY 2026)

The Autonomy Working Group (AWG) is aimed at enhancing automation and integrating autonomous systems into the NAS. By working in close cooperation with relevant stakeholders (e.g., FAA, other government entities, industry), the Autonomy Working Group 's goal is to establish a practical framework and a strategic roadmap to guide the FAA in this complex integration process. The Autonomy Working Group will engage with industry stakeholders through various forums to collect relevant data relating to autonomous air operations, analyzing these inputs from an operations-focused perspective. The Autonomy Working Group framework will guide this analysis, mapping out industry deviations from existing Instrument Flight Rules/Visual Flight Rules (IFR/ VFR) operational practices, regulations/rules, air traffic procedures, and associated policies. The gaps identified will form the basis for establishing the FAA's autonomy roadmap, identifying the activities needed to integrate these operations and associated

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[113] DOT, FAA (2023) *Advanced Air Mobility Implementation Plan*, https://www.faa.gov/air-taxis/implementation-plan.
[114] Public Law 110-63

Urban Air Mobility Airspace Management Demonstration (FY 2022–FY 2024)

The Urban Air Mobility Airspace Management Demonstration project was a collaboration with industry pioneers and leaders to showcase and highlight the concepts described in the Urban Air Mobility vision document and leverage the efforts of previous and concurrent research. This project assumed an iterative approach to demonstrate Urban Air Mobility elements and showcase operations with increasing complexity in measured and controlled steps. Based on the accomplishments of the previous research, this project developed the use cases, scenarios, and plans that were the basis of guided discussions to establish the structure for the test and showcase activities.

This project presented an opportunity to create and manage notional Urban Air Mobility corridors and architecture components that support information exchanges in the ecosystem, showcase novel aircraft capabilities and coordination between FAA, Urban Air Mobility operators, service providers, and other public interests.

Planned Evidence-Building Activities

The FAA will complete several critical policy development milestones in 2024-2026, including the publication of the Powered-Lift Special Federal Aviation Rule (SFAR). The SFAR will set initial requirements for how powered-lift aircraft are expected to operate. This will be based on data collected from aircraft manufacturers to date including aircraft performance and expected operational use cases.[115]

The FAA will update its interim vertiport guidance by the end of 2024, with a goal to publish a performance-based advisory circular by the end of 2025. This will be based on live flight operational testing to understand aircraft performance during takeoff, landing, approach, and departure.

Known or Potential Data

AAM Aircraft Wake Separation Data
AAM Aircraft Performance Models including Vertiport Operational Testing Data
AAM Route Structures
AAM Aircraft Equipage
AAM Operational Information
UAM Ecosystem Data Requirements
Autonomous Flight System Capabilities
NAS-External Systems Connectivity Requirements
NAS Communications Operational Tolerances

Tools

The FAA plans to use various modeling and simulation tools at the William J. Hughes Technical Center, such as the Target Generation Facility (TGF), the NASA-developed Advanced Trajectory Services – Toolkit for Integrated Ground and Air Research (ATS-TIGAR) tool for fast-time simulation, and high-fidelity NAS Labs for conducting Human-in-the-Loop (HITL) simulations. These tools will help assess plans to integrate AAM operations at a specific airport. This will also determine what the effects on traditional aviation at that specific airport would be.

The FAA leverages various working groups and projects to Interact with industry participants to facilitate the open exchange of information. Interaction with future aircraft developers and third-party service providers enables the FAA to refine the concepts of operations and drive standards and requirements.

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[115] Office of the *Federal Register* (2023) "Integration of Powered-Lift: Pilot Certification and Operations; Miscellaneous Amendments Related to Rotorcraft and Airplanes," *Federal Register*, Docket No. FAA-2023-1275, https://www.federalregister.gov/documents/2023/06/14/2023-11497/integration-of-powered-lift-pilot-certification-and-operations-miscellaneous-amendments-related-to

Methods and Analytical Approaches

The FAA signed a Memorandum of Understanding (MOU) with the U.S. Air Force AFWERX Prime Division (USAF AFWERX Prime) to support the FAA's efforts to safely accelerate the integration of emerging technologies in the NAS through joint flight-testing activities. This MOU will enable essential interactions between the FAA and the USAF to support the leveraging of capabilities and expertise for the testing of AAM aircraft. The parties expect this MOU will ensure:

- Early FAA understanding of related emerging technologies (i.e., capabilities and limitations);
- Emerging technology development informs FAA certification, policy, standards and NAS integration requirements; and
- USAF AFWERX Prime technology developer participants gain the knowledge and understanding of future FAA civil technology integration activities.

The FAA's I28 program is currently developing and refining analytical plans to assess the safe integration of AAM operations into the NAS. The current approach, which is being refined, involves the following:

- Communicate with airport, local, and industry stakeholders at a specific site to make sure they are all aligned.
- Conduct modeling and simulation activities of a specific site to see the effects of integrating AAM operations at that location.
- Bring in local stakeholders and air traffic controllers from the specific location and conduct feasibility testing in a simulated environment.

FAA is leveraging the outputs of the AWG to understand the evolution of autonomous systems development and shape regulatory changes. Activities include:

- Analyzing research conducted internationally regarding automation of transportation systems.
- Focusing internal resources and technical experts to identify and address gaps.
- Establishing a framework and roadmap for integration of autonomous systems in NAS.
- Informing standards bodies to improve outcomes.

Urban Air Mobility Concept of Operations and Urban Air Mobility Airspace Management Demonstration are establishing a basis for future implementation of UAM operations through the following:

- Collaboration with industry stakeholders and third-party service providers.
- Simulation and live demonstration activities to validate conceptual elements.
- Capturing outputs of research and socializing with standards bodies to drive standards development.
- Aligning FAA's conceptual direction with industry needs.

Anticipated Challenges and Mitigation Strategies

New policies will need to be developed to ensure safe AAM operations, and the development of this policy depends on the collection of novel AAM aircraft performance data. Thus far, it has been a challenge to receive this data from the various manufacturers. This could present challenges which may impact FAA and industry progress.

The FAA has developed test plans that identify AAM aircraft performance data requirements that align with policy needs. FAA staff are working directly with key industry members to identify testing opportunities. Research and collaboration with industry is planned to continue in order to mitigate any potential setbacks during the FAA's policy development processes.

FINDINGS FROM THE LEARNING AGENDA: FY 2022-2026

This section shares findings from evidence-building activities that DOT completed to address three topic areas introduced by the DOT Learning Agenda: FY 2022-2026. This includes findings on Drug Impaired Driving, Aviation Weather Cameras, and the Demographic Characteristics of DOT Job Applicants.

Drug Impaired Driving

To what extent does drug impairment play a role in crashes?

In late 2022, NHTSA completed the research project Alcohol and Drug Prevalence Among Seriously or Fatally Injured Road Users, whose products include a report and public data set.[116] Using a convenience sample (that was not nationally representative) from crashes where a road user was injured or killed, researchers found that overall, 55.8% of the injured or killed roadway users tested positive for one or more drugs (including alcohol) on the study's toxicology panel. The toxicology panel tested for alcohol, cannabinoids, stimulants, sedatives, opioids, antidepressants, over-the-counter, and other drugs not found in those categories. Of those sampled, researchers found that 23% of injured road users had alcohol in their systems, 25% had active cannabinoids in their systems, and 20% were positive for two or more drug categories.[117] These findings suggest the continued importance of programs preventing alcohol and drug-impaired driving.

Building off this study, NHTSA is planning a research project to explore the feasibility of a nationally representative sentinel surveillance system for drugs among seriously or fatally injured road users to monitor the national prevalence of drug and alcohol use by drivers that are admitted to trauma centers and medical examiner's offices across the country.[118] NHTSA is also planning the next iteration of the National Roadside Survey of Alcohol and Drug Use By Drivers, which was last conducted in 2013-2014.[119]

Aviation Weather Camera Service

What localized characteristics and other factors are associated with significant safety benefits from weather camera services? How are those characteristics distributed across potential locations?

The FAA's Weather Camera Program improves aviation safety and efficiencies by providing current visual weather information in the form of near real time camera images to aviation users. The images offer pilots, dispatchers, and Flight Service Specialists current weather conditions at airports, mountain passes, and strategic locations along regular-use air routes and areas with elevated accident

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[116] F. Thomas, J. Darrah et al (2022) *Alcohol and Drug Prevalence Among Seriously or Fatally Injured Road Users*, DOT HS 813 399, https://rosap.ntl.bts.gov/view/dot/65623 and https://rosap.ntl.bts.gov/view/dot/73638

[117] Convenience sampling is a non-probability sampling method where units are selected for inclusion in the sample because they are the most feasible for the researcher to access.

[120] Sentinel surveillance systems allow researchers to monitor the rate of specific conditions in a population by using a voluntary network of participants to report health events.

[119] DOT, NHTSA (2016) *2013-2014 National Roadside Study of Alcohol and Drug Use By Drivers*, https://www.nhtsa.gov/behavioral-research/2013-14-national-roadside-study-alcohol-and-drug-use-drivers#2013-14-national-roadside-study-of-alcohol-and-drug-use-by-drivers

rates. This service reduces weather-related aviation accidents and flight interruptions, improves flight decision making, and enhances Flight Service operations.

Limited or no weather information at uncontrolled airports and along normal flight routes contributes to a higher risk of accidents and flight inefficiencies. The lack of adequate weather information has prompted safety recommendations and mandates from various groups including the National Transportation Safety Board and the Senate Transportation, Housing, and Urban Development Committee.

Weather camera images are used for enhanced situational awareness. The images are made available free to the aviation community on a public website https://weathercams.faa.gov. When combined with other available textual weather products, weather camera images become a powerful visual reference to aid in pre-flight and enroute decision making. Over a seven-year period, the previous implementation of the Federal Aviation Administration (FAA) weather camera service in Alaska contributed to an 85% reduction in weather-related accidents (0.28 weather related accidents per 100,000 hours of operations in 2007 to 0.04 in 2014) and a 69% reduction in weather-related flight interruptions (15,374 hours of weather-related flight disruptions in 2007 to 5,129 in 2014).

The Weather Camera Enhancement 1 builds upon the successes of the baselined WCP and will expand the operationally deployed system by installing up to 160 additional camera systems in Alaska and throughout the continental United States.

The FAA completed a cost-benefit analysis and prioritization of optimal weather camera service areas for the Weather Camera Program expansion and approved the Final Investment Decision in August 2023. A quantitative analysis of data (historical aviation weather-related accidents, flight track data, ceiling data, elevation data, and aviation user feedback) identified and documented weather-related impacted areas. The benefits analysis used the weather-related impacted areas to monetize accident avoidance in those selected areas as well as the expected reduction in flight hours as the result of diversions. The selected 160 candidate weather camera service areas are those that provided the highest safety and efficiency benefits. The program uses the candidate area analysis to facilitate the weather camera installation planning. The site surveys and installations for the expansion are ongoing. Completion of all 160 sites is scheduled for August 2031.

Related Documents

- "Weather Camera Image Overlays," *1800WxBrief*, https://www.1800wxbrief.com/Website/#!/news/90.

- "New Visibility Estimation Tool Coming Soon," FAA Safety Briefing (March/April 2023), https://www.faa.gov/sites/faa.gov/files/MarApr2023.pdf

- "Omnipresence: The Gift of Being and 'Seeing' Elsewhere," https://express.adobe.com/page/v8WXvOeXrssA5/

Demographic Characteristics of DOT's Job Applicants

What are the demographics of applicant pools for all DOT occupations?

To advance the DOT Equity goal in the *FY 2022 – 2026 Strategic Plan*, the Department aims for the share of DOT personnel by sex, disability, race, and ethnicity to mirror representation in the U.S. labor force and for earnings to be equal for all persons with the same skill sets regardless of sex, disability, race, or ethnicity.

DOT's Volpe Center analyzed the demographic characteristics of about 1.4 million job applicants from about 27,000 DOT job announcements for eight priority, mission-critical engineering and IT occupations from 2015 through 2020. The demographic characteristics analyzed were race/ethnicity, gender, and disability status. The analysis found critical points where major discrepancies by race, ethnicity, and gender appear or widen in the DOT career life cycle. It also found that while women made up fewer than 15% of applicants to engineering and Information Technology (IT) positions, female applicants were 1.7 times more likely to be hired for these positions than male applicants.

DOT applied the evidence from this analysis to improve operations through three pathways. First, DOT put a renewed focus on increasing the number of women who apply to DOT's engineering and IT positions by refining its recruitment strategies. DOT identified

outreach opportunities to organizations supporting women in engineering and IT, hosted information sessions with current women in engineering and IT positions ahead of the DOT-wide virtual job fairs, and increased engagement at colleges and universities with large numbers of women in engineering programs.

The effectiveness of DOT's recruitment strategies will be assessed in part by the second pathway, which is the use of a key performance indicator to monitor the diversity of the applicant pool. This performance goal tracks the increase in the diversity of applicants for mission-critical occupations in each Operating Administration. The Department publicly reports on progress through its *Annual Performance Plan and Performance Report*. In FY 2023, women made up 18% of applicants for the Department's mission-critical engineering and IT positions.

For the third pathway, DOT is developing an internal dashboard that will allow each Operating Administrations access to analysis of its workforce and applicant flow data. This dashboard will help Operating Administrations identify additional opportunities to increase diversity that are unique to its workforce.

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