Readout: Workshop on Crafting a National Climate Change Research Agenda for Transportation

Background

Substantial Federal research and technology investments related to climate change and transportation are made at multiple Federal agencies. However, the opportunity exists for the U.S. Department of Transportation (USDOT) to fill critical gaps and advance research, policy-relevant analytics, and technology transfer activities related to climate and transportation, while avoiding duplication of Federal activities. This opportunity aligns with USDOT's legislative mandate under The Energy Independence and Security Act of 2007 (Public Law 110-140), Section 1101.[1] This opportunity also aligns with USDOT's Research, Development, and Technology Strategic Plan for Fiscal Years 2022–2026[2] supported by 49 U.S.C Chapter 65 (Research Planning),[3] and with the National Academies' Seventh EU-U.S. Transportation Research Symposium: Global Pathways to Net-Zero. This paper calls for renewed investment into research and development at existing DOT and DOE programs that will result in lower-cost technologies, university research into reducing vehicle miles, and research on resilience and land-use priorities.

To make progress towards this opportunity, USDOT, in partnership with the Federation of American Scientists (FAS), hosted a "Workshop on Crafting a National Climate Change Research Agenda" at the 2025 Annual Meeting of the Transportation Research Board (TRB). The workshop, which included approximately 30 stakeholders from academia; federal, state, and regional governments; and other sectors, was intended to surface expert perspectives that could directly inform USDOT-funded research efforts, as well as support and guide non-federal research and development activities.

This readout captures key themes, insights, and recommendations from the workshop.

Insights and Recommendations

Decarbonization of the Transportation Sector

Insights

- **Integration of Life Cycle Analysis and Holistic Planning.** The focus on life-cycle analysis (LCA) to capture the full range of carbon emissions associated with different aspects of transportation is growing, but integrating it effectively into policies, planning,

[1] This mandate is codified in 49 USC Section 102(g), which establishes in USDOT an "Office of Climate Change and Environment plan, coordinate, and implement (A) department-wide research, strategies, and department-wide research, strategies, and actions under the Department's statutory authority to reduce transportation-related energy use and mitigate the effects of climate change; and (B) department-wide research strategies and actions to address the impacts of climate change on transportation systems and infrastructure."
[2] The Plan calls for USDOT RD&T efforts that "aim to substantially reduce transportation-related greenhouse gas emissions and pollution while building more resilient and sustainable transportation systems to benefit and protect communities."
[3] This Code describes the primary purposes of the transportation research and development program, which shall include (A) improving mobility of people and goods; (B) reducing congestion; (C) promoting safety; (D) improving the durability and extending the life of transportation infrastructure; (E) preserving the environment; (F) preserving the existing transportation system; and (G) reducing transportation cybersecurity risks.

and research remains a significant challenge. Standardizing and harmonizing LCA methodologies is crucial for enabling consistent analysis across regions and projects. A new approach is Social Life Cycle Analysis that assesses the social and sociological aspects of a product in its whole life cycle (e.g., from mining of the raw material through final disposal).

- **Decarbonization as a Multimodal Strategy.** Mode shifting, electrification, and infrastructure design are central to decarbonizing transportation. Demonstration projects and pilot programs and policies that focus on system-level mobility solutions, renewable energy integration, and innovative technologies like Mobility-as-a-Service could significantly drive these efforts. Research that takes place-based, family- and household-based, and "whole traveler" perspectives is especially likely to generate multimodal, system-of-systems insights.
- **USDOT's Role in Driving Climate Innovation and Partnerships.** USDOT's access to vast travel and household data, relationships with state DOTs, national scale, and international collaborations give it unique capabilities to lead on transportation decarbonization. However, slow adoption cycles and underleveraged private-sector partnerships are barriers to maximizing this potential. Research on the social and organizational processes of innovation could be used to accelerate innovation.
- **Advancing energy efficient and low-emission technology.** USDOT plays a unique role as a regulatory and funding agency. Continuing to advance technology toward lower-emission drivetrains, fuels, modes, and complementary technology will be crucial to meeting the department's (and complementary) decarbonization goals. This includes continuing to push on the advancement of electric and alternative fuel vehicle technology to be more efficient and safe.

Recommendations

- **Enhance Research on Mode Shifting and Infrastructure Innovation.** Promote studies on the effectiveness of mobility hubs, multimodal connections, and technologies like inductive charging. Focus on quantifying the climate and societal co-benefits of these strategies to influence policy adoption.
- **Expand and Formalize Public-Private Collaborations.** Establish a dedicated public-private task force within USDOT to identify shared priorities, co-develop standards (e.g., for hydrogen and EV technology), and accelerate private investments. Offer competitive incentives for innovations that reduce transportation emissions at scale, and encourage localities to boost their decarbonization strategies by building community capacity for engagement with transportation planners.
- **Expedite Technology Transfer and Standardization Efforts.** Leverage OST-R and ARPA-I to speed up the development, testing, and scaling of cutting-edge technologies. Provide resources for standardizing life-cycle assessments and GHG emissions modeling, ensuring consistency across federal, state, and local levels. Conduct behavioral research to identify and overcome the barriers to adoption.

- **Evaluate the Effectiveness of Existing Efforts.** Researchers should evaluate the emissions savings, safety improvements, and economic impacts of existing USDOT programs based on measurable metrics. These findings should be used to prioritize which programs to continue, and which to change. Programs implemented in the Bipartisan Infrastructure Law and Inflation Reduction Act, in particular, are opportunities to evaluate the outcomes of an experiment.

Climate Resilience of Transportation

Insights

- **Disconnect Between Climate Science and Infrastructure Design.** There is a significant gap between the availability of climate data/science and its practical application in designing transportation infrastructure. This divide inhibits effective resilience measures and long-term performance assessments. As climate models develop finer geographical resolution, and as climate science better integrates micro- and meso-scale extreme weather events with macro-scale climate change, infrastructure design offers important applications.
- **Regional Disparities in Climate Vulnerability.** A lack of comprehensive understanding of regional climate vulnerabilities, especially in resource-constrained areas, highlights a need for region-specific modeling and targeted strategies to address threats effectively. Such questions are at the forefront of climate modeling, so there is rapid scientific progress in this area.
- **Absence of Standard Metrics for Resilience.** The absence of clear, standardized metrics for assessing resilience complicates efforts to measure success, guide funding allocation, and ensure that investments in resilient infrastructure are sustainable and future-proof. Other agencies' work in this area (e.g., the U.S. Global Change Research Program's work on Climate Services) could be a valuable resource.

Recommendations

- **Bridge the Data-to-Application Gap.** Establish national initiatives to develop actionable frameworks for integrating climate data into lifecycle analyses and design processes. Focus on practitioner-friendly tools to incorporate regional climate models into infrastructure resilience efforts, and coordinate with private industry.
- **Develop National Reporting and Performance Metrics.** Create a standardized USDOT report to track how resilience-focused USDOT grants (e.g., PROTECT awards) are being utilized by recipients. Additionally, establish robust performance measures at USDOT to evaluate and adapt resilience strategies over time.
- **Prioritize Targeted, Scalable Funding Initiatives.** Allocate funding towards a mix of innovative low-cost pilots and large-scale transformative projects. Ensure that competitive award processes are aligned with industry insights to identify scalable and impactful resilience solutions.

Social-Science Approaches to Climate, Equity, and Transportation

Insights

- **Human Behavior is Complex and Context-Driven.** Transportation decisions are not solely influenced by rational factors like cost and time. Emotional, social, and contextual elements (e.g., security, family dynamics, life events) also play a significant role. Individuals' priorities often shift based on life stages, infrastructure access, and unforeseen personal or societal events. This indicates a need for richer behavioral models that integrate these diverse influences. On the resilience side, the scientific literature on natural disasters offers a wealth of information on how transportation systems can make populations more resilient to disasters, which are becoming more common as climate change accelerates.

- **Systemic and Institutional Challenges Limit Engagement.** Most current community engagement methods are top-down and fail to adequately align with the lived experiences of users. Furthermore, a disconnect between policymakers and community needs creates a barrier for inclusive decision-making. There is evidence of frustration among professionals due to the difficulty of addressing these challenges through existing policy and modeling structures. Too often, transportation planners present projects to communities at a stage that is too advanced for community members to engage with planners as problem-solvers, resulting in situations where planners and the public, both trying to do the right thing, come to see each other as opponents and roadblocks instead of problem-solving collaborators.

- **Key Opportunities Lie in Communication and Contextual Framing.** Both communication strategies (e.g., simplifying and highlighting co-benefits such as cost savings, independence, and social connectivity) and the physical/social design of transportation systems (e.g., aesthetics, social engagement spaces) significantly influence behavioral change. Research from non-transport domains like public health provides transferable lessons for encouraging long-term changes in behavior. The social and behavioral sciences have developed useful new knowledge about how cultural frames, narratives, and identities shape climate-related behavior.

Recommendations

- **Develop and Deploy Context-Rich Behavioral Models.** Build transportation models that incorporate qualitative insights, contextual factors, and behavioral science concepts. Richer behavioral models from the field of innovation science can also help reduce the lag from innovation to adoption. Prioritize life-stage-specific interventions (e.g., transitioning students, young parents) and test these models in controlled environments or via natural experiments before applying them to broader policy decisions.

- **Expand Community-Driven Decision-Making.** Shift from a top-down approach to collaborative engagement by empowering users to participate in shaping transit policies. Invest in localized pilot programs to build community capacity, adopt iterative feedback loops with users, and foster partnerships with grassroots organizations that reflect diverse mobility experiences. Public engagement is a fast-moving field that builds on social and behavioral science (e.g., processes of building and rebuilding trust).

- **Enhance Communication Strategies.** Frame transportation choices in terms of their tangible, immediate benefits (e.g., time saved, money saved, and security) using targeted messaging for specific demographic groups. Especially in a nation as heterogeneous and large as the United States, what works for one set of life circumstances in one place probably doesn't work everywhere. Rural areas, for instance, have distinct transportation needs and communication channels. Employ creative, place-based, socially differentiated communication tools like public art and accessible, data-driven narratives to increase adoption rates and trust in alternative transit systems. Such approaches can be rigorously evaluated with field experiments, natural experiments, and survey experiments.