



NATIONALLY SCALING TRANSPORTATION ADVANCEMENTS

By implementing a comprehensive approach to nationally scale proven transportation innovations, the incoming administration can save lives on the road, reduce travel time for all, accelerate the flow of critical goods, and protect our planet from harmful emissions.

The Case for Action

Highways, public transit, heavy rail, aviation, and waterways connect our communities to healthcare, food, schools, and work and serve a critical role in national defense and disaster relief. Unfortunately, transportation challenges are pervasive. The United States is facing an increasing trend in road fatalities, travelers continue to experience delays despite access to real-time traffic information, vehicle owners are concerned about buying electric cars and trucks without a national charging network, and commodity flows are disrupted due to more and higher-intensity infrastructure failures.

Imagine a transportation system with zero fatalities,¹ equitable mobility for all, net-zero emissions, and resilient supply chains. For more than two decades, the U.S. government and its partners have researched, developed, and tested advanced technologies for integration with infrastructure and vehicles at local levels. These investments have resulted in roadway designs that protect pedestrians, real-time video-enabled management of corridor traffic flows, smaller and more powerful electric batteries, and connected truck platoons, among other innovations. Despite their positive and wide-ranging benefits, persistent barriers remain to scaling proven transportation innovations across the country.

We recommend the incoming administration provide leadership, direction, and tools to scale transportation innovations in a way that maximizes investment benefits, manages technical interoperability, and engenders public trust.

Key Challenges and Opportunities

Nationally scaling transportation innovations presents challenges and opportunities resulting from the distributed nature of transportation planning and management among state, local, tribal, and territorial governments; the continuous rapid development of transportation technology solutions; and the complex interactions within the transportation system.

The identified challenges and opportunities call for the incoming administration to lead the national scaling of transportation advancements, building on ongoing investments and the existing technology innovation community.

MITRE's mission-driven teams are dedicated to solving problems for a safer world. Through our public-private partnerships and federally funded R&D centers, we work across government and in partnership with industry to tackle challenges to the safety, stability, and well-being of our nation.

Investment Decisions Among System-of-Systems Uncertainties

Transportation investment decisions are hampered by uncertainty about the impacts of changes to the transportation system of systems spanning infrastructure, vehicles, fleets, operators, and communications, among other subsystems. It is easy to imagine how a widespread cyber disruption, like the AT&T service outage in February 2024 or the CrowdStrike event in July 2024, could have cascading and long-lasting negative impacts on our nation's transportation system, representing how policy and investment decisions distributed across transportation stakeholders might be informed by more collaborative planning and management. Stakeholders making isolated decisions have limited information to estimate safety, efficiency, economic, and environmental impacts of their decisions. The federal government has an opportunity to provide leadership as its grant and formula programs invest hundreds of millions of dollars in cross-modal innovations and deployments each year. Transportation system-of-systems modeling tools provide an opportunity for the federal government to bring together transportation innovators to explore the people, processes, and technologies related to their innovation areas; examine the societal impacts; and share the results with other stakeholders.

Technical Interoperability

Transportation technology is rapidly advancing, with diverse stakeholders driving innovation in automation, communication, cybersecurity, telematics, data analytics, and artificial intelligence (AI). With advancements occurring simultaneously through federal grants, deployments are at risk of creating incompatible solutions that inhibit the intended benefits and broader adoption in U.S. communities. Today's deployments must feature technology frameworks that are engineered to interoperate with legacy and future systems. The federal government has the opportunity to connect transportation innovators and equip them with tools to test technical interoperability early in the development cycle.

Public Reservations with Transportation Automation

Unprecedented federal investments in transportation infrastructure and operations paired with publicly accessible advancements in AI, like ChatGPT, have raised the American public's expectations for automation applications to improve transportation. Relatedly, recent setbacks for automated

vehicle deployments in cities are eroding public confidence in the long-term viability of transportation automation. Americans also demand privacy and security from their transportation system, which runs at odds with the increased surveillance and networked communications associated with transportation automation. Existing cumbersome and slow rulemaking processes cannot keep pace with the need for the federal government to regulate transportation automation applications. The federal government has an opportunity to address public concerns about transportation automation by partnering with automation developers to ensure their capabilities meet the public's expectations.

Data-Driven Recommendations

The identified challenges and opportunities call for the incoming administration to lead the national scaling of transportation advancements, building on ongoing investments and the existing technology innovation community.

Evaluate Transportation Investment Benefits with an Integrated Multimodal Perspective

Analytical models can inform prioritization of transportation infrastructure investments by modeling their complex interactions and forecasting the collective impact in terms of economic, environmental, energy, and equity factors. For example, models can help identify efficiency chokepoints and single points of failure, analyze fiscal policies related to electric vehicle adoption, and forecast job creation and workforce development needs based on federal investments. We recommend the federal government leverage its current grant administration efforts to evaluate the integrated impacts of transportation grant outlays by geographic region. We suggest this interagency and multi-level government initiative aim to clarify integrated multimodal impacts of transportation investments, increasing the government's ability to evaluate the effectiveness of individual and combinations of investments and informing government decisions to invest additional funding in geographic areas with the highest-priority needs.

Evaluate Technology Interoperability During Development

Due to the transportation system's complex interdependencies, technology interoperability requires collaborative testing as technologies are developed. We recommend the next administration establish an interagency

initiative to evaluate and implement technical interoperability approaches to reach transportation innovators at all levels. We recommend the technical interoperability initiative put tools and processes in place to ensure new and legacy assets communicate with one another and work as intended, potentially leveraging digital twins. Tools to evaluate technology interoperability would be valuable to examine grant projects by geographic region and to inform infrastructure deployment decisions.

Assure Transportation Automation

As the United States seeks to responsibly deploy automated vehicles and other transportation automation, regulatory and certification processes must be flexible and adaptable to meet the technology's performance while prioritizing safety and protecting proprietary information. As a first step, we recommend the federal government examine how to streamline its process to validate automated vehicles' safety performance. We recommend this initiative aim to fill the critical safety assurance gap between controlled track testing and high-consequence road testing. The resulting certification process should provide a secure, objective, and accessible environment to test automated vehicles in a variety of scenarios. The federal government can leverage lessons learned to streamline certification processes for additional transportation automation applications.

Implementation Considerations

To achieve nationally scaled transportation advancements, the incoming administration must direct collaboration among multiple federal agencies and non-federal transportation innovators to implement the previously discussed recommendations.

Interagency Collaboration

The Department of Transportation's (DOT) national research and technology strategy² has helped align transportation advancements, and the DOT should continue to lead the government to scale transportation investments. The DOT and Department of Energy should continue to partner,³ next establishing a repeatable process to examine the intended benefits of grant projects and their interactions using multimodal models. Regarding technical interoperability, we recommend the DOT continue to partner with the National Institute for Standards and Technology to define minimum standards for transportation assets and expand this partnership into interoperability testing and automation assurance.

National Collaboration

State, local, tribal, and territorial governments as well as private industry and academia have key roles in scaling transportation advancements nationally. The recommended toolset for evaluating investment benefits, evaluating technology interoperability, and assuring transportation automation must be accessible for government and nongovernment entities to contribute, potentially via a virtual platform.

Resource Allocation

Scaling transportation advancements to additional communities will require strategic use of existing resources, primarily from the Bipartisan Infrastructure Law. We suggest the incoming administration prioritize investments in the recommended tools and allow the tools to guide investments to the technology areas and communities with the greatest needs.

Timeline

In the first 100 days, we recommend the administration initiate an interagency task force responsible for scaling transportation developments nationally. By the end of the first year, we suggest the task force have plans in place to address the related challenges and opportunities, considering the toolsets we recommended. As a priority in the first year, we also recommend evaluating the integrated benefits of the nearly \$350 million in transportation grants announced as part of the Bipartisan Infrastructure Law as of July 2024 and incorporating this evaluation process into the award phase for future grants.

MITRE Resources and Support

MITRE operates the DOT's only federally funded research and development center on behalf of the Federal Aviation Administration, with the mission to serve the public interest by advancing the safety, security, effectiveness, and efficiency of aerospace and transportation in the United States and around the world. MITRE is uniquely positioned to support the incoming administration in scaling transportation advancements nationally.

Investment Analysis Expertise

MITRE provides multidisciplinary analyses and products that enable the government to acquire, create, and deploy systems and processes that are mission effective and lifecycle affordable.⁴ We can assist in creating investment analysis tools tailored for transportation. Our Multimodal U.S.⁵ is a nationwide transportation model that leverages data from government and industry sectors to offer comprehensive insight into the nation's integrated transportation system by estimating the movement of passengers, goods, and services across the United States at macro-, meso-, and micro-scales.

Technical Interoperability Tools and Analysis

MITRE operates the Virtual Open Innovation Collaboration Environment for Safety (VOICES), a platform for organizations to jointly test the interoperability of transportation automation and connectivity assets before deployment.⁶ Recently, the DOT and MITRE, together with technology developers and academia, demonstrated technology interoperability testing via the VOICES platform. With the government's support, MITRE can scale the VOICES platform to meet multimodal interoperability testing needs.

Automation Assurance Tools

MITRE has deep expertise in automation and automation assurance, operating the Artificial Intelligence Assurance and Discovery Lab⁷ to proactively discover and mitigate mission-critical risks in AI-enabled systems. MITRE's Digital Proving Ground⁸ is a secure, validated, and objective environment to demonstrate automated vehicle technologies are safe before deployment on public roads. We can use these tools in collaboration with industry and state, tribal, local, and territorial governments to support the incoming administration's goals to address the public's reservations regarding transportation automation.

About the Center for Data-Driven Policy

The Center for Data-Driven Policy, bolstered by the extensive expertise of MITRE's approximately 10,000 employees, provides impartial, evidence-based, and nonpartisan insights to inform government policy decisions. MITRE, which operates several federally funded research and development centers, is prohibited from lobbying. Furthermore, we do not develop products, have no owners or shareholders, and do not compete with industry. This unique position, combined with MITRE's unwavering commitment to scientific integrity and to work in the public interest, empowers the Center to conduct thorough policy analyses free from political or commercial pressures that could influence our decision-making process, technical findings, or policy recommendations. This ensures our approach and recommendations remain genuinely objective and data-driven.

Connect with us at policy@mitre.org

Endnotes

¹ DOT, National Roadway Safety Strategy, January 2022, available at <https://www.transportation.gov/NRSS>.

² DOT, Research Development and Technology Strategic Plan FY2022-26, January 2023, available at <https://www.transportation.gov/rdtstrategicplan>.

³ Joint Office of Energy and Transportation, available at <https://driveelectric.gov/>.

⁴ MITRE, Cost, Acquisition, and Management Sciences Center, available at <https://www.mitre.org/our-impact/mitre-labs/cost-acquisition-and-management-sciences-center>.

⁵ MITRE, Multimodal U.S. Transportation Analytic Environment, July 2023, available at <https://www.mitre.org/news-insights/publication/multimodal-us-transportation-must-analytic-environment>.

⁶ MITRE, VOICES Platform to Catalyze Collaborative Research on Automotive Technology, May 2024, available at <https://www.mitre.org/news-insights/impact-story/voices-platform-catalyze-collaborative-research-automotive-technology>.

⁷ MITRE, AI Assurance and Discovery Lab, June 2024, available at <https://www.mitre.org/news-insights/fact-sheet/ai-assurance-discovery-lab>.

⁸ MITRE, Advancing the Use of Simulation in ADS Safety Assurance, March 2024, available at <https://www.mitre.org/news-insights/publication/advancing-use-simulation-ads-safety-assurance#:~:text=By%20Joseph%20Kolly%2C%20Ph.D.&text=MITRE%20is%20working%20across%20the,Digital%20Proving%20Ground%20test%20environment>.