



At a Crossroads: U.S. Transportation Faces a Challenging Route Ahead

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Introduction

The U.S. is undergoing rapid changes in technology, values, culture, and demographics, all of which are causing a transformation in transportation. The historic transportation infrastructure challenges—transportation funding shortfalls and a backlog of needs for aging infrastructure—are compounded with new challenges. Significant resources and attention are being directed to ensuring equity in access and impacts, intentions to reduce carbon emissions, increasing resilience to weather events, and ramping up attention to the perennial problem of unacceptable levels of transportation safety. Simultaneously, the transportation field is adapting to emerging technologies, including electrification, automation, and application of artificial intelligence. Technology has enabled significant changes in transportation, such as rapid increases in work-from-home participation, e-commerce utilization, and technology-enabled services and business models (e.g., everything from ride-hailing and e-bikes to computer-enabled logistics, payment, and scheduling capabilities for person and freight transport).

Building and maintaining U.S. transportation infrastructure is now inherently more challenging. A large share of investment needed to rebuild and enhance infrastructure is in mature, highly developed, congested, and complex metropolitan environments. In the face of partisanship in legislative and executive bodies, highly connected public and powerful stakeholder groups are aggressively involved in influencing transportation policies and investment priorities. Increasing polarization based on constituents' values, needs, behaviors, and priorities precludes standard strategies and further complicates decision-making. One consequence of all these external pressures is a growing tension between those with a mobility-focused, market-driven vision, and those who advocate for having climate and equity considerations prescribe the future of transportation.

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But these challenges are not without corresponding opportunities. Technology has been profoundly beneficial to transportation—ushering in broad safety improvements, dramatically improved emissions and energy efficiency, enhanced logistics providing consumers unprecedented access to products and services, more advanced materials, near-ubiquitous opportunities to substitute communication for travel, and steady progress toward carbon reduction, automation, and artificial intelligence deployment in transportation. These trends indicate a promising future and have engaged and motivated a bright, diverse, and multidisciplinary workforce.

This paper explores the critical decisions policymakers must make to ensure that the future of U.S. transportation remains secure and advocates efforts to drive economic growth and improve the quality of life for all Americans.

It's All About Mobility

Transportation is foundational to modern society. It supports human survival by enabling the movement of people and products that are the foundation of modern production and commerce. Mobility enables the productivity derived from the economic and employment specialization that produces economies of scale and agglomeration. Travel facilitates social interactions critical to our quality of life and allows us to exercise the human desire to explore opportunities and curiosities.

Mobility has long motivated both public and private investments in transportation facilities and services, but increasing knowledge about the consequences and externalities of transportation is resulting in policymakers and executives weighing additional considerations in their decisions. For example, sensitivity to environmental impacts has extended from concerns about mitigating the physical impact of transportation infrastructure on the natural and built environment to alarm about greenhouse gas emissions.

At the same time, we increasingly appreciate transportation's role in the global and national economy. The impact of the Covid-19 pandemic on global trade and supply chains and the disruptions from events like the Francis Scott Key Bridge collapse in Maryland have made consumers aware of the link between the goods available to them and the transportation infrastructure. The public is also aware of the connection between travel and economic opportunity as well as quality of life. There is a growing interest in understanding how transportation can influence physical activity levels and the health of individuals. At every level, Americans are more aware of how transportation impacts them personally. This allows for more informed decisions but also risks complicating and polarizing transportation decision-making in a time of much-needed investment.

In the U.S., transportation constitutes the second-largest spending category for household incomes, making up about 15% of household spending,¹ and consumes about an hour of the average American's daily waking time.² Transportation produces 29% of U.S. greenhouse gas emissions and consumes a significant share of energy.³ Travel safety is a critical factor in quality of life and a top fatality risk for some age cohorts.⁴ Directly and indirectly, transportation employs a large share of the workforce. Virtually every inhabited parcel of land is connected by some type of travel infrastructure, and although transportation infrastructure consumes a very small percent of the total land area of the country, it accounts for as much as a quarter of the land in central business districts.⁵

Every element of the built environment is enabled by transportation. Every product to build and operate our homes and workplaces is delivered by transportation. All our waste materials and refuse are hauled away by transportation. Even if individuals do not need to travel for work

or pleasure, all the products and materials that feed, house, clothe, and entertain them and the people who serve and visit them must be transported to and from them. In short, transportation plays a profound role in human existence.

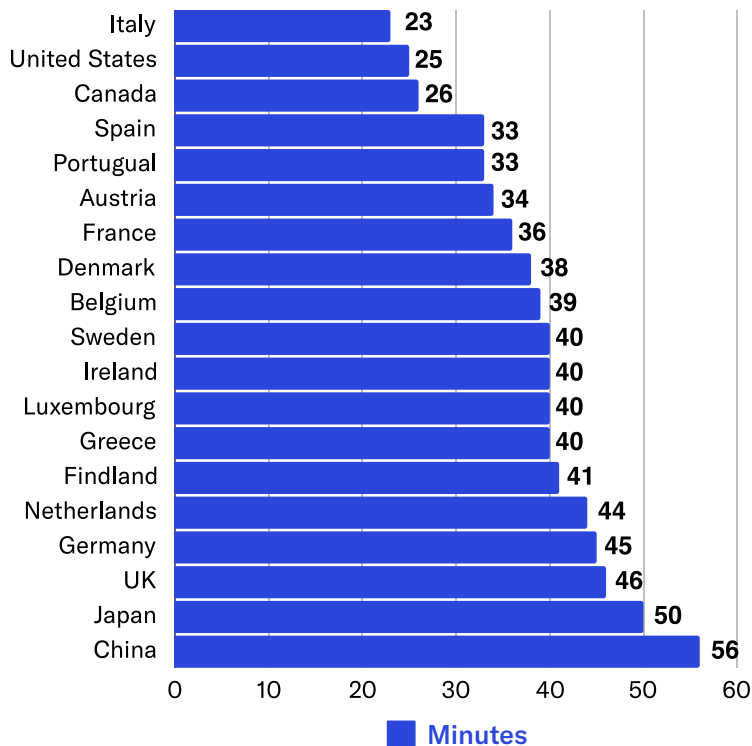
Transportation infrastructure and services are also fundamental to the economic success of the United States. Transportation enables a vigorous economy that benefits all of society, and the productivity and wealth supported by high-quality transportation fund our society’s safety net programs and social services.

Mobility enables enhanced economic productivity by providing individuals more access not only to employment opportunities to leverage their skills and talents to their best effect but also to more education to enhance those skills. Because of modern transportation, employers have access to a larger workforce talent pool and a larger variety of suppliers; businesses have access to more customers, who have access to more product and service choices. Greater mobility means better and more resilient supply chains and lower costs for producers and consumers, enabling economies of scale and agglomeration to enhance productivity, wealth production, and a higher quality of life. Safe, fast, and low-cost transportation infrastructure undergirds the competitiveness of the U.S. economy and American productivity.

The 2019 Global Competitiveness Report ranked the U.S. number 2, behind Singapore, in competitiveness, and infrastructure was one of 12 metrics used in that scoring.⁶ To look at just a single way in which transportation infrastructure can make Americans more productive, and meet their travel needs and expectations in daily life, consider the much-maligned daily commute. **Figure 1** shows a distinct U.S. advantage in commute times and ease of mobility compared to various developed countries.

Figure 1

Average Daily Commuting Time, 2015 (One-Way, in Minutes)



Source: Jean-Paul Rodrigue, *The Geography of Transport Systems*, 6th ed. (New York: Routledge, 2024)

The foundational goal for transportation policymakers must be to sustain and enhance our transportation infrastructure so that it can accommodate improved safety, growth, resilience, impact mitigation, and technological enhancements. This will require continued, disciplined, and substantial investment. At the same time, it is critical for policymakers remain focused on core mobility goals so that the U.S. can continue to drive economic growth and improve the quality of life of all Americans.

Maintaining the focus on mobility will mean that transportation governance must be cautious in embracing goals beyond its mandate, expertise, or resource capacities. While transportation entities need to be partners in addressing broader societal issues, they cannot be expected to be leaders in addressing issues like homelessness, income disparities, urban crime, mental health, substance addiction, housing affordability, or climate change. There is an opportunity cost for diverting too much attention to issues beyond the key mobility responsibilities of transportation agencies.

Complicated Governance and Contradictory Goals

It's frustrating to hit a pothole, whether it happens literally in our drive to the grocery store or metaphorically when we face a more complicated navigational and logistical challenge in our infrastructure, and transportation is a target-rich environment for such frustrations. This section will review some of the causes of those frustrations, especially how transportation goals are established and how governance is handled. The tasks of goal setting and governance are complex.

Multiple levels of government are partners in supplying infrastructure and services—from funding and permitting boards to safety inspectors and from labor to businesses. Government administrators and legislative bodies are responsible for making a broad array of decisions on transportation investments, operations, and policies. Accordingly, attempts to improve transportation often include consideration of changes to myriad aspects of governance.

Transportation goal setting is also increasingly complicated and spread over more issues. Therefore, there are more stakeholders than in the past. The set of aspirations for transportation has grown as more has been learned about how transportation impacts virtually every aspect of life. The historic broad bipartisan support for accessible, safe, and affordable transportation has given way to additional considerations, including environmental objectives, equity considerations, and social, quality of life and economic concerns. It is not uncommon to see other aspirations working their way into goal sets such as “sustainable,” “resilient,” “flexible,” “adaptable,” “innovative,” “transformative,” and others.

Broader goals have made decision-making more difficult as there is voluminous, complex, and often uncertain information on each issue set and disagreement over how to interpret and prioritize the findings.

Governance

Governance for transportation is extremely diverse across jurisdictions. Multiple levels of government are frequently involved in transportation decisions often with both funding contributions and approval roles for various initiatives. Levels can include local communities, county-level entities, states, regional entities (including those involving multiple states), and federal entities. In many cases, there may be several agencies or departments involved in approvals within a given governmental level.



The governance challenges are further complicated by the growth of metropolitan areas that now encompass broad geographies and embrace a multitude of local government entities with significant transportation interactions across large regions. Institutional diversity has also grown, with a huge variety of institutional structures for specific transportation needs. In addition to general-purpose governments, there are authorities for ports, airports, public transportation, toll roads, and occasionally for regulation of taxis or other mobility services. There is also vast variation in how transportation is owned and governed across multiple jurisdictions. For example, the role of states can vary dramatically, from owning most of the roadway network and operating public transportation to a far more modest role focusing on narrower segments of transportation systems. Ports, airports, toll operations, and transit authorities can be parts of general-purpose government or governed by independent governing agencies. Metropolitan area size, scale, and proximity to adjacent metropolitan areas can influence the structure and governance framework.

There is no consistent standard or compelling evidence regarding the best way to govern transportation.⁷ There may be political clout and economies of scale for larger entities, but they may be less responsive to customer needs and less effective in the face of burdensome and complex administrative procedures. Or they may be insensitive to diverse local conditions.

There are varying degrees of connectedness among agencies, making it unclear to an agency when a task falls within its purview or with one of their partners. Dedicated agencies can be focused and strong advocates for accomplishing the agency's objectives, yet they can also be insensitive to balancing those aspirations against broader governmental goals. As is the case in democratic political systems, transportation policymaking can also become commingled with decision-making for unrelated issues.

The diverse and complex governance arrangements for transportation are only part of the challenge for decision-makers.

Goals

The great challenge of decision-making is making tradeoffs. In transportation, that tradeoff is often between mobility and affordability with other aspirations.

Historically, Americans have benefited from comparatively low-cost transportation. Airlines, for example, generate approximately \$0.20 in revenue per passenger mile of operation, and this revenue funds operations, aircraft, and airline contributions to airport infrastructure.⁸ The IRS estimates that the cost of operating an automobile is \$0.67 per mile in 2024. Accounting for average vehicle occupancy brings the per passenger mile cost to \$0.44.⁹ While these estimates benefit from the value of historic investments to support those modes of transportation, and other sources of government funding, they highlight the potential implications of amortizing the costs of new investments over the estimated lifetime number of passengers served. Government-owned-and-operated services like Amtrak and public transit can have per-passenger-mile costs several multiples higher. New roadway facilities in urban areas with high right-of-way costs, high maintenance of traffic costs, high mitigation costs, and burdensome procurement requirements can similarly result in dramatically higher costs.

Contributing to high costs is the need to accommodate the goals and expectations of many different transportation stakeholders. Many projects are collaborative initiatives across different locations, levels of government, and stakeholder groups, and multiple stakeholders can extract concessions and prescribe specific elements of the project or service in response to their priorities as a condition of their support. This may impact design characteristics, amenities, mitigation initiatives, etc., and it will likely significantly increase project costs. Resolving this challenge might require, at a minimum, a greater appreciation of costs. It could also potentially require restructuring decision-making to be more programmatic and reducing the requirement for unanimous, multi-entity decisions on individual initiatives.

As stated, multiple stakeholders will usually have their respective goals, and these rival goals will always include costs. Among the goals most commonly attached to transportation initiatives is equity, including racial or gender equity. Traditionally, equity has been considered in transportation investments focused on geography but, more recently, equity has been “centered” as a department-wide goal of transportation governance, including at the U.S. Department of Transportation.¹⁰ This is a critical challenge because of the disconnect it creates with market needs.

Efficiency and cost-effectiveness in transportation are highly dependent upon scaling the investment in proportion to the demand so that the facilities and services can function productively. To the extent that calls for equity result in transportation investments driven by equity considerations and not demand, it will challenge an investment’s productivity and its ultimate contribution to the economy. Impacting productivity can also undermine another common stakeholder goal: carbon reduction per passenger mile. This can also occur if equity considerations result in investments where market conditions do not support their productive operation.

Another challenge influencing goal-setting is the evolving role of the federal government in prescribing more of the specific details and selection criteria of eligible projects utilizing federal funds. Historically, formulas determined the federal funds flowing to the states, which gave the states considerable discretion on spending. There have always been legal, environmental, and other parameters connected to federal funds, but there has been a growing tendency for congressional or executive actions to set more conditions that may or may not be consistent with local priorities or needs, which risks steering resources into investments that may not be high priorities or cost-effective (from a transportation perspective) in some geographic locations. This tension between local needs versus federally prescribed criteria can cause friction between levels of government and impact the geographic or political equity in the distribution of funds, as some applicants are better able to compete for projects based on certain criteria.

The latest challenge to the federal government’s role came from the recent Supreme Court decision in the *Chevron* deference case, which addressed the issue of federal administrative agencies interpreting legislative intent regulating various governance actions.¹¹ Conflicts arose when interested parties believed that regulatory agencies went beyond or misinterpreted legislative intent. Historically the courts deferred to administrative agencies, but this new ruling will have courts making judgments that attempt to discern legislative intent.

Recommendations

While there is no consensus on the best governance structure for transportation agencies, these issues merit attention from policymakers and industry experts:

Transportation requires leadership attention. The rather staid, low-profile nature of transportation governance is a testament to (1) the professional workforce and (2) the generally shared vision of past governance. But transportation is evolving under complex conditions, and it needs a renewed commitment of leadership attention to make informed decisions. Transportation decision-makers must educate themselves on the emerging critical issues facing transportation and society today, including technology deployment, multidisciplinary stakeholders, diverse contexts, and dynamic conditions.

Administrative processes require reform. The bureaucratic and lengthy government processes to make decisions and execute plans need to be updated. Permitting and procurement, for example, need to be regularly evaluated and modified to be responsive.

Context matters. Conditions are so diverse across the U.S. that we must not presume that what worked in one state or locality will work in another. Major transportation decisions inevitably involve multiple government entities, and it is critical to understand the respective authorities and interrelationships with appropriate communications channels.

Be wary of easy answers. While governance changes may be appropriate to keep up with evolving conditions and can invigorate or revitalize an agency, governance changes can take years to implement, and they do not necessarily make challenging decisions easier.

Process or structure is not enough for success. Governance structure cannot substitute for integrity, commitment, competence, and leadership by the players involved.

Strengthen public-private relationships. The private sector has great access to technologies and talent. Government entities need to engage with the private sector to facilitate the delivery of quality transportation.

The Path Forward for Transportation Funding

Discussions on the future of transportation do not go very far before funding arises as an issue. Funding comes not just from the individual level—households purchasing their vehicles and paying for tolls and gas—but also from the several levels of government and private-sector stakeholders. Resources not associated with travel also fund transportation. These include sales taxes, often used to support public transportation, and property and income taxes that provide general fund revenues used for various modes of transportation.

We are at a critical crossroads in funding transportation. Revenue needs have outpaced their traditional sources, particularly at the federal level.¹² Meanwhile, improved fuel efficiencies, modest vehicle travel growth, and the electrification of transportation have all created a funding gap as our transportation infrastructure has heavily relied on revenue from fuel taxes. Rapid infrastructure cost inflation, stakeholder pressures to expand funding for nontraditional initiatives, and demand for facilities that do not generate revenue, such as bike and pedestrian lanes, exacerbate this challenge. Federal investment is occurring in areas such as funding charging infrastructure, incentivizing electrification of the vehicle fleets, and supporting freight operations like truck parking and rail system enhancements. These investment aspirations are occurring at a time when it may be increasingly challenging to consistently provide general fund commitments via revenue transfers to supplement declining transportation-sourced revenues in the Highway Trust Fund (HTF).¹³

Multiple initiatives have attempted to address this need, ranging from congressionally mandated studies to the work of the Congressional Research Office to stakeholder documents.^{14, 15, 16, 17} Progress at the federal level has generally been stymied by the political challenges associated with burdening travelers or taxpayers with increased costs. One funding effort was the 2021 Infrastructure and Jobs Act (IIJA), which authorized \$118 billion in general fund transfers for new infrastructure projects.¹⁸ Congressional Research Office forecasts indicate a cumulative deficit in transportation trust fund revenues of nearly \$300 billion by FY 2034, premised on spending levels growing with inflation beyond the current authorization.¹⁹ The frequency of gas tank fill-ups increases stakeholders' sensitivity (including every car and truck owner in the U.S.) to higher costs. Whether it is filling a fuel tank, paying a transit fare, using a ride-hail service, buying an airline ticket, or paying delivery fees on orders, consumers feel the impact of direct and indirect transportation costs.

When IIJA expires in September 2026, Congress will again need to address the funding challenge with transfers from the general fund or new revenues to cover the shortfall in the HTF. The reauthorization process should bring critical attention to the levels of federal funding, the sources of those funds, and its allocation across transportation needs and priorities.

Beyond simply sourcing federal transportation funds, pending decisions about federal transportation funding have repercussions across multiple policies. Defining a path forward for transportation funding implicitly requires addressing several critical policy issues. These key issues are noted briefly below.

Federal Funding Levels

Some have characterized IIJA's transportation components and supplemental funding during the Covid-19 pandemic as a generational investment in transportation infrastructure. By contrast, many transportation professionals and studies indicate the need for sustained higher funding levels to support the operations, maintenance, and renewal of transportation systems.²⁰ The impact of the inflation spike on transportation infrastructure costs, a 59% increase in the cost index between the fourth quarter of 2019 and 2023,²¹ and the prospects of continuing new initiatives included in the IIJA, further strengthen stakeholder motivations for sustaining or enhancing federal investment levels going forward.

Implications for Federal Involvement

The level of federal funding partially defines the federal role in transportation, but it also influences funding and spending decisions at state, regional, and local agencies, and the private sector. It impacts the workforce and the businesses providing transportation infrastructure in the United States. To the extent that federal funding falls short of transportation needs, as judged by stakeholders or industry analyses, it may result in deteriorating systems and the quality of service. It may also result in other governments assuming even more responsibility. A mismatch between stakeholder aspirations and taxpayer generosity will signal a need for either a more compelling case for funding projects or a recalibration of stakeholder expectations. Sometimes stakeholder "needs" are better understood as "wants," after considering the public's willingness to incur debt or support higher transportation taxes and fees.

Some analysts have characterized the growing share of roadway improvements being funded by state and local governments as a de facto devolution of responsibility from the federal government to states and localities. From 2010 to 2019, the federal share of governmental transportation spending declined from 26.3% to 22.7%, before IIJA revenues restored the federal share to approximately the levels in 2010.²² If federal funding levels are not sustained at levels meaningfully above pre-IIJA levels or levels supported by current user fee revenue streams, policy analysts have postulated different scenarios where the federal government's resources are focused more narrowly on high-priority national interests to more appropriately match the funding commitments. Many argue that federal investment should go to programs or projects that have a true national impact on enhancing or maintaining economic activity, but a no-change, kick-the-can scenario might spread resources more thinly over the ever-broadening set of programs and risk the satisfactory attainment of many transportation goals.

Stable and Predictable Funding Levels

Uncertainty has a cost. Over the past several authorization and appropriation cycles at the federal level, delays and uncertainty have impacted and complicated the delivery of transportation projects. Funding uncertainty can significantly delay the execution of projects, particularly those that are influenced by seasonal procurement and execution strategies, and it can also influence

the contracts for finished projects, resulting in both delays and higher costs. That uncertainty also impedes the productivity of the administration, planning, procurement, and delivery of transportation investments.

Funding uncertainty also has longer-term implications, such as threatening subsequent phases of projects or the future operations of facilities and vehicles. It may also impact states, regional, and local entities that must sometimes await federal funding decisions before determining local or regional funding needs and allocations.

User-Fee-Based Transportation Funding

Reluctance to increase fuel taxes and Highway Trust Fund (HTF) fees has resulted in reliance on general fund revenue supplements at the federal level; in other words, increased deficit spending to fund transportation. This compromises the spending discipline inherent in a user-fee-based funding strategy. When projects rely on user fees, spending plans have to be justified relative to the political will to sustain or increase those fees. User fee dependence has the benefit of curbing the overuse of equity considerations in the distribution of funds, and it helpfully provides feedback to consumers on the real cost of travel.

User fees can influence a host of transportation decisions. When subject to higher fuel taxes, businesses and individuals may consider fuel efficiency in their vehicle buying decisions. Trip plans, transportation methods, and trip destination and length may also be influenced by the cost of travel such as fuel or mileage fees. Even lifestyle decisions—such as how far one chooses to live from work—can be influenced by travel costs. User fees also provide a committed revenue stream, reducing reliance on discretionary political decisions on general revenue allocations.

Government Involvement in Travel Pricing

Many sectors of the U.S. transportation system have historically depended on market-based pricing as a primary source of revenue and as a factor in influencing the services provided. Allowing transportation to operate at market rates engages the private sector to provide services. While complex funding arrangements across components of the transportation system and an unwillingness to compensate all externalities of transportation precludes pure market-based pricing of transportation, several modes are highly dependent on market-based pricing and demand levels. The supply of services such as airlines, intercity buses, taxi and ride-hail services, freight delivery, and other elements of the transportation system are determined by market-based pricing.

Increasing government involvement in transportation pricing could potentially impact private-sector engagement in transportation. For example, public transportation and intercity rail have not been sustainable as wholly private businesses, so they transitioned to publicly subsidized and regulated services. Additional public involvement in pricing or regulatory actions that impact the cost competitiveness of providing some transportation services may negatively influence the willingness of businesses to provide transportation absent governmental subsidies. These transitions may be subtle. For example, federal involvement in subsidizing electric vehicle charging stations may diminish the incentive for the private sector to provide those services. Defining a path forward where charging infrastructure transitions to a wholly private operation may therefore be prudent.

Attempts to accommodate economically disadvantaged consumers by regulating the price of transportation options versus user-side subsidies could also impact the willingness of the private sector to engage in transportation projects that depend on fares.

Transitioning From the Fuel Tax

Vehicles' improved fuel efficiency, the diminished rate of growth in travel, and the transition to electric vehicles has resulted in a significant drop in fuel tax revenues. This source of funding historically dominates the federal HTF and state transportation funding but it is also important for some transit authorities.²³ Policymakers have known about this challenge for years, but sources of funding to replace the tax have not been widely accepted or deployed. Between 2013 and 2021, 33 states and the District of Columbia enacted legislation that increased their gas tax, and approximately half of states have authorized some form of assessment on electric vehicles to compensate for them not consuming fuel.²⁴ The federal government has been reluctant to increase fuel taxes since 1993, citing considerations ranging from the regressive nature of fuel taxes to the keen public awareness of and sensitivity to the cost of fueling vehicles. Today's trillion-dollar-plus annual budget deficits may have desensitized policymakers to the significance of multiple billion-dollar general fund transfers to HTF.

This reluctance for reform is reinforced by the challenges inherent in transitioning to a mileage-based user-fee structure. While explorations of such programs have identified various costs and benefits, the political challenge of simultaneously transitioning the funding mechanism and increasing the user charges to keep up with inflation and needs, has been insurmountable. Considerations such as administrative costs, personal privacy, the complexity of integrating collections across federal, state, regional, and local governments (as is currently the case with fuel taxes), determining equity across vehicle classes, risks of fraud, and other factors have slowed progress and dampened enthusiasm.

Affordability Versus Worth

Transportation challenges in most areas focus on how resources can be found to do all the things that stakeholders aspire to do. Virtually every goal turns into a question about how it can be afforded and who can pay for it, not whether it is cost-effective to do it or do it the way it is proposed. Moderating expectations through compromise regarding design features, amenities, phasing or staging, levels of performance, and other features are seldom part of such discussions. Similarly, opportunities to generate off-setting revenues seldom get attention. Regardless of the goals policymakers are pursuing, there should be a rigorous benefit/cost analysis and costs should not be discounted lightly because they are being shouldered at the national rather than the local level.

There is always a balance between value and affordability. For years analysts have explored strategies for controlling transportation infrastructure costs, including alternative procurement strategies, enhanced value engineering initiatives, simplified and expedited environmental approval processes, accelerated project timelines, integration of new materials, greater private-sector participation and/or privatization of projects, and the prospect of reevaluating numerous regulatory aspects of transportation procurement and implementation. Many of these issues are highlighted in analyses of comparative construction costs for public transit in the U.S. versus internationally,²⁵ but it is still often a struggle to deliver cost-effective transportation investments, despite these efforts. The current inflationary environment for construction costs coupled with funding challenges suggests a need to revisit and accelerate efforts to control transportation costs.

Recommendations

Several critical action items regarding transportation funding require attention:

Future federal funding levels and priorities should be determined. While only one of the overall transportation revenue sources, federal funding is critical because it shapes the size and scope of transportation spending and defines the role of federal engagement.

Transportation needs stable and predictable funding. Effective and efficient programs and steady progress require stable and predictable funding. Planning for this at the federal level should start now to enable a timely reauthorization of federal legislation in September 2026, which will then enable states and locals to plan accordingly.

Be cautious in abandoning user-fee-based funding. User-fee-based funding provides some curbs on the equitable distribution of transportation funds and provides feedback to travelers influencing their travel decisions. Market-based pricing enables private sector participation in transportation and supports efficient operations.

Address HTF revenue needs. Stable transportation funding will require accommodations to account for inflation and the improved efficiency and electrification of transportation vehicles.

Controlling costs requires comprehensive and aggressive attention. Project cost escalation undermines public support and threatens policymakers' ability to attain their goals for transportation investment. A broad-based review of every aspect of transportation project execution is required. Elements that need to be scrutinized in the interest of controlling costs include: Planning and cost estimating, regulatory burdens and approval processes, phasing and staging, project design, project scope and amenities, strategies for dealing with uncertainty and risk, work rules, and maintenance of traffic strategies.

The Future Transportation Workforce

Directly and indirectly, transportation is a major employer across fields and disciplines. From the artificial intelligence experts working to advance automated vehicles, to the truck driver steering an 18-wheeler, to the courtesy assistant helping a disabled traveler access a paratransit vehicle, to the construction worker repairing roadway pavements, transportation engages a huge, diverse, multidisciplinary segment of the workforce. Nevertheless, the challenge of attracting and retaining a productive workforce confronts transportation. For example, there has recently been broad media attention regarding the shortages of air traffic controllers, truck drivers, and other transit and construction workers.²⁶ The shortages extend across skill areas and projects into the future as many segments of the transportation workforce face retirement cliffs.²⁷ The workforce capacity problems are compounded by critical shortages of and aggressive competition for highly skilled professionals who are required to operate increasingly sophisticated systems and technologies.

The exciting emerging technologies involved in automation, the transition to emissions-free vehicles, and smart vehicles have all increased the visibility of transportation professions. This renewed attention creates motivating challenges and opportunities for the workforce and attracts new talent, energy, and skilled workers. The industry will need highly skilled analysts, data scientists, and technicians to operate modern transportation systems, especially as artificial intelligence develops. This new generation of workers should be able to command compensation levels surpassing historic norms in a profession often highly dependent on government employment, where compensation levels and workplace culture are not competitive with private-sector opportunities. Extremely bureaucratic administrative procedures, a regulatory and cultural environment not conducive to rapid change, the lack of a critical mass of subject area talent, and the lack of defined career paths can stifle current and potential employees. Furthermore, although some transportation agencies seek out a diverse workforce, those aspirations can be frustrated when the talent pool for highly

credentialed and experienced professionals is limited. The absence of a diverse talent pipeline due to years of modest investment and interest in transportation leaves thin talent pools with the necessary training and experience.

Ramped up investment levels from IJTA and state and local initiatives will help build the workforce, but it will take time. The technical components of the transportation system are sophisticated and specialized enough that there will need to be strong partnerships between the public and private sectors to facilitate innovation by leveraging the talent pools in private-sector firms. Agencies and firms will similarly need to capture the experience of the aging workforce to transfer knowledge to the next generation of transportation professionals. Initiatives (i.e., position rotation programs, career training in transportation content, mentoring) will be required to enhance workforce competency and speed the knowledge gains for new workforce members who may not have followed traditional paths to transportation careers. Attracting these new multidisciplinary workforce members may also require everything from embracing telework to providing more competitive salaries and benefits packages to rethinking credential requirements and career path options.

Finally, Artificial Intelligence (AI) can be harnessed by transportation professionals to handle a variety of tasks. Everything from improved logistics to customer interactions to plan development can benefit from AI. While AI can help address the professional capacity needs of transportation going forward, the workforce will need to be familiar with the technology to utilize AI.

Potential actions to support the transportation workforce include:

- Provide supplemental education initiatives to provide a multidisciplinary talent pool with a foundational knowledge of transportation to enable them to be productive members of the transportation workforce.
- Adapt changes necessary to appeal to the aspirations of the next-generation workforce. This may require meaningful changes in processes and practices.

Conclusion and Next Steps

This paper only scratches the surface but attempts to address several key issues in mapping a path forward for transportation policy. Perhaps the top need is for governance bodies responsible for transportation decision-making to commit the time and attention necessary to address these critical issues and have the resolve to make the sometimes-difficult decisions necessary for a productive path forward.

Society and the transportation industry have changed and are continuing to change, and policies, programs, and investment priorities must reflect the new realities. Stakeholders must be able to accept tradeoffs in light of multiple and sometimes competing goals and have the information and resources necessary to make informed decisions. This is particularly true at the federal level, where the resource commitments must be in sync with bipartisan legislative support. Government will similarly be challenged to update procedures and processes, build competent workforces, define a disciplined goal set and performance measures, and establish systems necessary to execute in a complex dynamic environment.

Many of the needs and challenges of the transportation industry are well-known—streamlining permitting and approval processes, leveraging emerging technologies, encouraging public-private partnerships, and resolving transportation funding challenges, among others. What has been missing is the will and discipline to address these challenges. The consequences of compounding problems

coupled with rapid changes in values and technology exacerbate the financial consequences of inaction and compromise our physical transportation landscape. If transportation is going to continue to sustain U.S. competitiveness and enhance the quality of life of Americans, the needs of our transportation system can no longer be ignored.

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