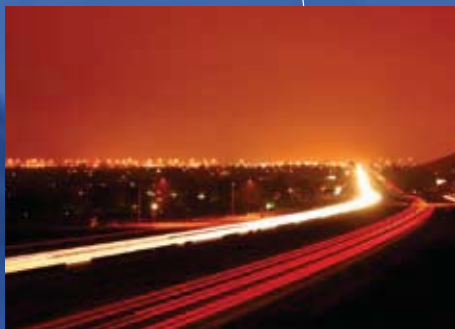




NATIONAL
TRANSPORTATION
POLICY PROJECT

Performance Driven: A New Vision for U.S. Transportation Policy

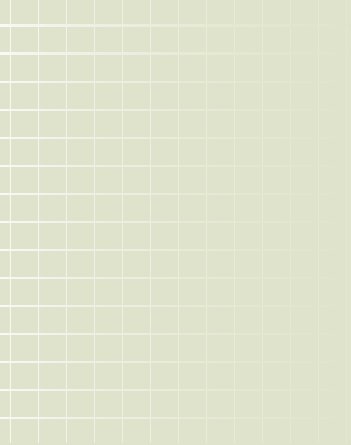


June 9, 2009

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Preamble

This report presents the findings of an intensive, two-year effort to develop multi-stakeholder consensus recommendations for a forward-looking American transportation policy. The NTPP's diverse membership includes experts and leaders in transportation policy, as well as users of the system whose voices have not typically been heard in previous policy debates. Collectively, Project participants represent a wide range of political, commercial, and stakeholder interests in the nation's transportation systems—and while some are well-versed in the intricacies of current programs and policies, the majority are not. The Project is chaired by four former elected officials who served at the federal, state, and local levels and have wide-ranging experience in public policy and management. Its aim has been to develop specific recommendations that are at once bold and pragmatic, sophisticated and understandable.

This report is the product of a bipartisan group of 26 members of diverse expertise and affiliations, addressing many complex and contentious topics. Arriving at a consensus document in these circumstances entailed multiple compromises. Accordingly, the reader should not assume that every member is entirely satisfied with every formulation in the report taken in isolation. Rather, we have reached consensus on the report and its recommendations *as a package*, which taken as a whole offers a balanced and comprehensive approach to the economic, environmental and energy security, safety, and national connectivity challenges facing transportation policy-makers. The findings and recommendations expressed herein are solely those of the Project Members and do not necessarily represent the views or opinions of the Bipartisan Policy Center, its Advisory Board, or its Board of Directors.

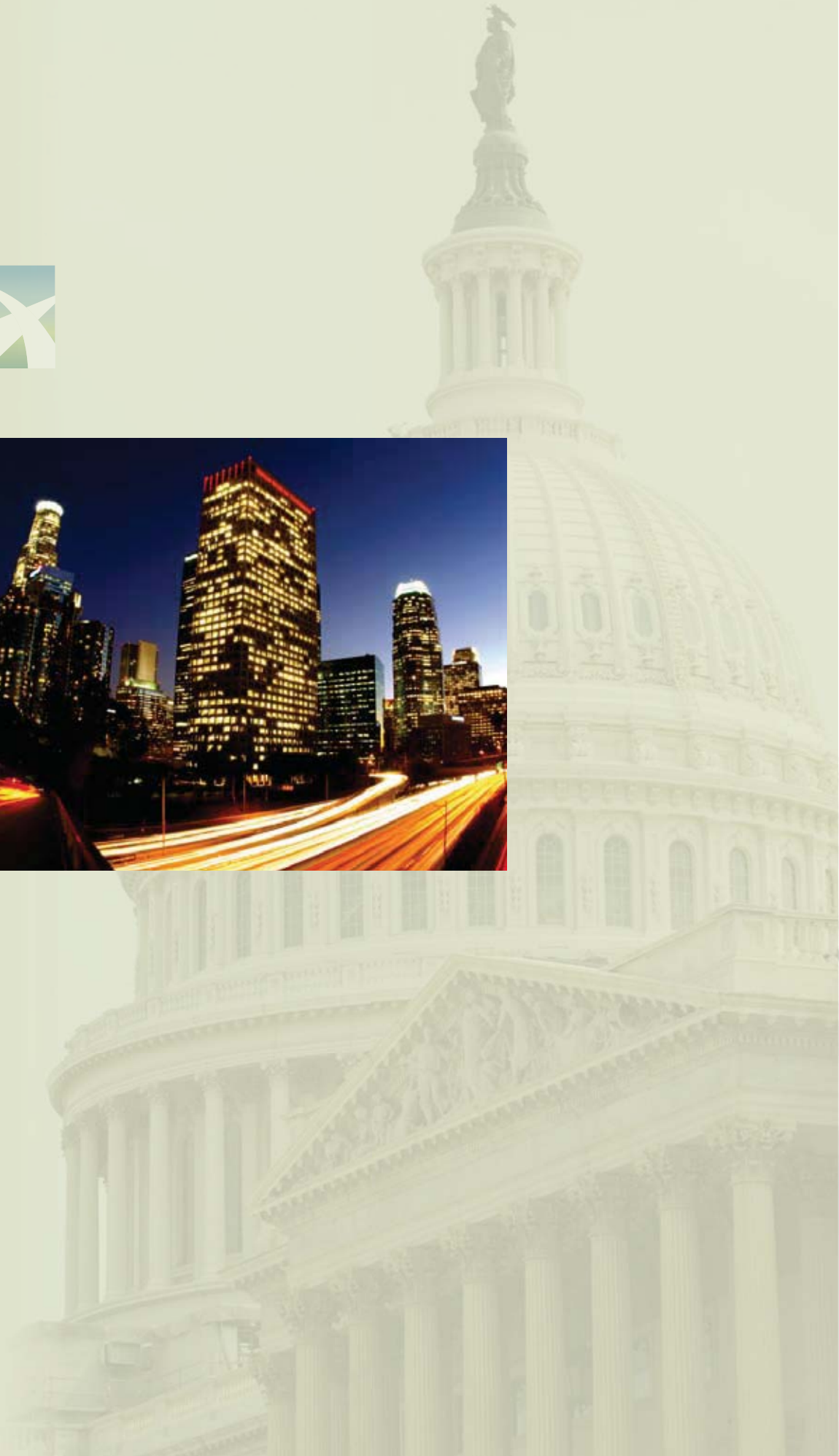




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U.S. transportation policy needs to be more performance-driven, more directly linked to a set of clearly articulated goals, and more accountable for results.





Executive Summary

National transportation policy has lost direction and a clear sense of purpose, threatening substantial costs to our collective prosperity, security, environment, and quality of life. We are recommending bold and comprehensive reform founded on a relatively simple proposition: *U.S. transportation policy needs to be more performance-driven, more directly linked to a set of clearly articulated goals, and more accountable for results.*

This is a period of extraordinary opportunity for revitalizing America's surface transportation system. The investments of the interstate-highway era, begun more than 50 years ago, are nearing or beyond their intended lifespan. Existing systems are dated, in many cases strained to (or beyond) capacity, and increasingly fall short of delivering transportation services at the level of quality, performance, and efficiency the American public demands. Current funding mechanisms are not sufficient to maintain existing infrastructure, let alone provide the investments needed to expand and modernize our transportation systems. The broader fiscal outlook—notwithstanding a near-term burst of stimulus spending—suggests that public resources will be more constrained than ever in the years ahead. Meanwhile, available resources are typically distributed without any sense of national priorities, and there is little to no recognition of the link between transportation investments, energy, and climate. As Congress prepares to debate a new surface transportation authorization bill, there is growing support for fundamental reform of our nation's transportation policies. There is also a growing awareness that our approach to transportation must

be responsive to a new set of 21st century challenges, from staying competitive in an increasingly globalized economy, to addressing urgent concerns about energy security and climate change.

There is little to no recognition of the link between transportation investments, energy, and climate.

Recognizing the need for a new vision for federal transportation policy, the National Transportation Policy Project (NTPP) was launched in February, 2008, with the aim of bringing new approaches and fresh thinking to these issues.¹ Our aim has been to develop proposals for transportation reform that are at once bold enough to be effective, and pragmatic enough to be relevant. To that end, the Project has been explicitly bipartisan in its approach and in its membership from the outset. NTPP is chaired by four former elected officials—two Republicans and two Democrats—and brings together a group of individuals with a broad diversity of political views and professional experiences. This includes experts and leaders in transportation policy, as well as users of the

¹ The NTPP is a project of the Bipartisan Policy Center, which was founded by former Senate majority leaders Howard Baker, George Mitchell, Tom Daschle, and Bob Dole and builds on a model for principled bipartisan cooperation and compromise first pioneered by the National Commission on Energy Policy (NCEP). For more information on the BPC and on its other projects in the areas of energy, national security, science and policy, and health care please visit www.bipartisanpolicy.org.

system whose voices have not typically been heard in previous policy debates. A full list of NTPP members is at the beginning of this report.

Federal Goals

Two central questions have motivated and guided NTPP's analytical work and deliberations over the nearly two years since the Project was launched:

- **Why and for what purposes should the federal government invest in transportation?**
- **How can the federal government ensure that any greater investment be wiser investment that effectively advances national purposes?**

Clearly, the first step toward a more focused and effective federal role was to answer the first question: What are the federal government's primary goals for transportation policy and transportation system investments? In this report, NTPP proposes five key goals, all of which are critical to the national interest and all of which—because of their intrinsically national nature—require federal leadership and action:

- **Economic Growth**—Producing maximum *economic growth* per dollar of investment
- **National Connectivity**—*Connecting* people and goods across the nation with effective surface transportation
- **Metropolitan Accessibility**—Providing efficient access to jobs, labor, and other activities throughout *metropolitan* areas
- **Energy Security and Environmental Protection**—Integrating *energy* security and environmental protection objectives with transportation policies and programs

- **Safety**—Improving *safety* by reducing the number of accidents, injuries, and fatalities associated with transportation

NTPP believes that this set of goals makes intuitive sense and would command broad support from the American public—and thus provides a strong foundation for a meaningful vision and fundamental reform. We are well

There is no federal requirement to optimize “returns” on public investments, and current programs are not structured to reward positive outcomes, or even to document them.

aware that bringing about such reform will be much harder than identifying goals. Implementing a performance-driven approach and introducing accountability will challenge entrenched interests and require government institutions at all levels to change longstanding practices and ways of doing business. Accordingly, our discussions next turned to the difficult task of developing objective performance metrics that can be used to choose among different investment options and, subsequently, to judge their results.

Measuring Performance

Without clearly articulated goals, it is not surprising that there has been little accountability for the performance of most federal transportation programs and projects to date. The result has been an emphasis on revenue sharing and process, rather than on results. There is no federal requirement to optimize “returns” on public investments, and current programs are not structured to reward positive outcomes, or even to document them.

Table 1: Proposed Performance Measures

Economic Growth	Energy and Environment	Safety
Access to jobs and labor (metropolitan accessibility)	Petroleum consumption	Fatalities and injuries per capita
Access to non-work activities (metropolitan accessibility)	CO ₂ emissions	Fatalities and injuries per Vehicle Miles Traveled (VMT)
Network utility (national connectivity)		
Corridor congestion (national connectivity)		

To remedy these deficiencies, it is not enough just to have goals—we also need a set of agreed-upon tools for objectively measuring how a given policy, program, or investment achieves progress toward those goals. Such tools, or performance metrics, must be fair, transparent, and free of bias toward particular transportation modes or geographic regions. Table 1 summarizes the performance metrics NTPP recommends for measuring performance with respect to each of the goals we identified at the outset (note that metropolitan accessibility and national connectivity are considered as components of economic growth).

Several further points bear emphasizing in a discussion of performance metrics. First, the metrics we have proposed, like the goals themselves, must be applied as a complete package, not in isolation. That means that any expenditure of federal funds should be targeted towards those investments that maximize benefits among all of these measures and minimize costs. Second, the specific metrics we have proposed represent only a starting point. They can and should evolve and improve over time to achieve better results, and to ensure that federal programs and policies remain fair and relevant. Finally, we recognize that substantial efforts will be needed in the area of data quality and

data collection to support the rigorous and meaningful application of metrics, and to refine and update them periodically. However, the relative lack of useful data in transportation reflects the fact that we have never had a performance-based system requiring it.

To achieve the recommended national goals and implement performance metrics, a comprehensive consolidation and restructuring of current programs— together with a fundamentally new approach to funding—are both required. These two urgent and perhaps more controversial issues are discussed in the next two sections of this summary.

Programmatic Structure

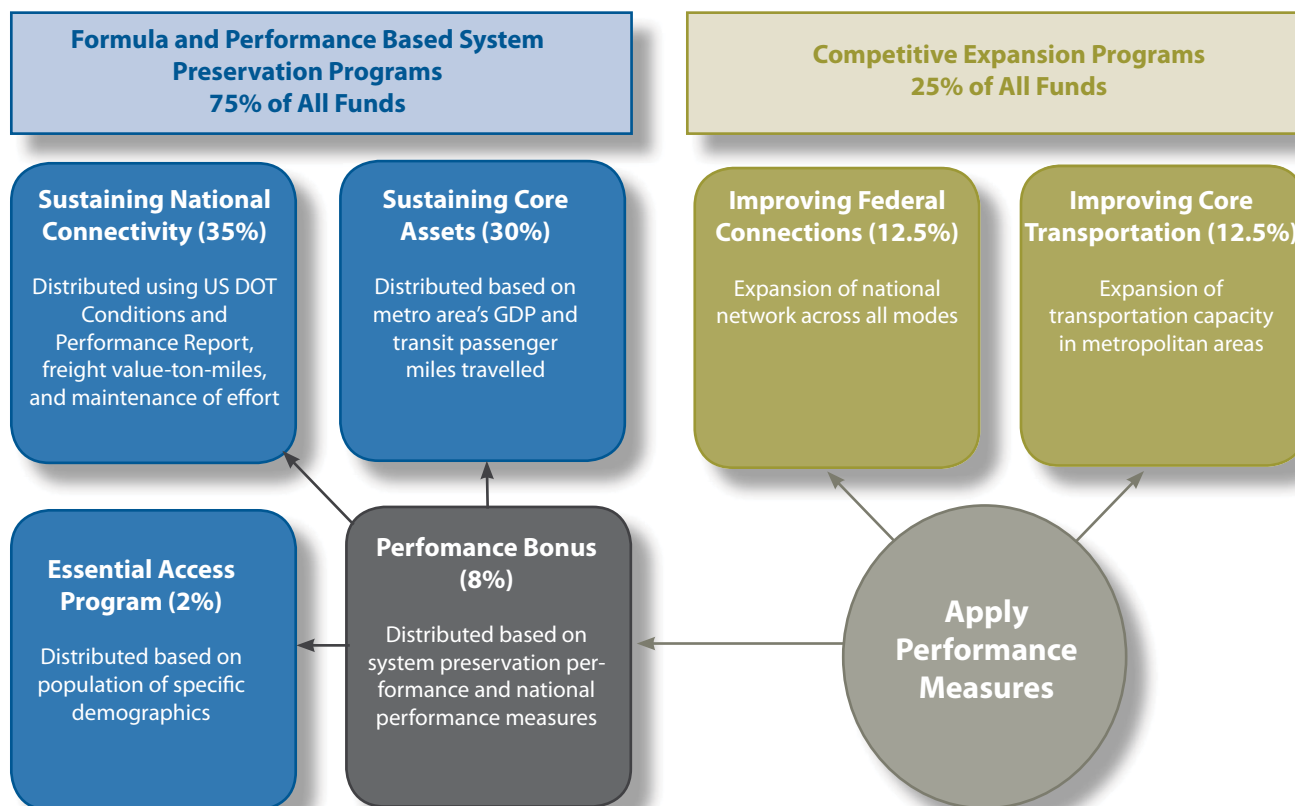
The last several surface transportation authorization bills have been marked by the rapid proliferation of federal transportation programs and by an increasing reliance on Congressional earmarks to direct federal transportation investments. Both are symptoms of the lack of focus and accountability we describe above. Addressing the root causes of these trends has become especially urgent in light of the longer-term fiscal realities that confront not only transportation programs, but all public investment. Despite the current surge of stimulus

spending, the nation's collective resources are stretched thin and will be stretched much thinner for the foreseeable future. In this context, directing more resources to transportation through a set of existing policies and programs that are unsustainable, unfocused, and underperforming is not only unwise, it is untenable.

We recommend a new structure that consolidates all current federal transportation programs into two categories: formula-based **system preservation** programs and competitive **capacity expansion** programs. This consolidation is quite extensive—from approximately 108 programs to six—but is essential to focus the programs on performance. Under this new structure, the vast majority of funds would continue to be distrib-

uted via formulas—except that these formulas would distribute funds based on new criteria. Current formula distribution criteria provide perverse incentives to increase fuel consumption and carbon emissions, whereas the new criteria would provide funding based on need. All existing formula programs would be merged into three programs and restructured to align with national goals. A separate program would be created to reward good performance with respect to the use of formula funds. All other funding would be distributed through competitive grant programs that are programmatic, multimodal, and based on the ability of grantees to demonstrate progress toward defined national goals. The basic structure we are proposing is schematically illustrated in Figure 1.

Figure 1: Proposed Federal Funding Programs



NEW FORMULA PROGRAMS

Based on clear evidence that improvements to the management and performance of existing transportation systems generally offer the highest returns, the majority of available funding should be directed to preserving and enhancing the infrastructure and systems that already exist. Timely federal investments in existing systems can maximize the value of investments made in past years and can often make expensive new capital projects unnecessary. Consistent with the national goals we recommend, formula funding for system preservation and optimization should be focused in two areas: (1) national connections and (2) metropolitan regions.

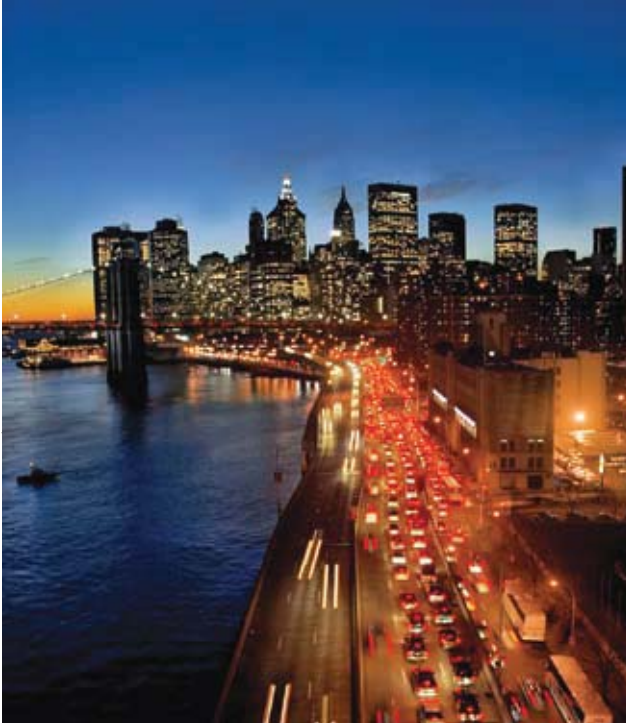
Specifically, we propose a new formula program called **Sustaining National Connectivity (SConnect)** that would target federal funds to those investments most necessary to preserve the national transportation system. A cost-based formula offers the simplest and most direct way of allocating federal funds under this program. Such a formula can, at least initially, make use of the analyses already conducted by U.S. DOT as part of its bi-annual Conditions and Performance report. Another factor to include in the formula could be freight value-ton-miles within a state, to account for rail preservation needs until an objective measure of needs based on freight congestion and bottlenecks can be developed. The formula could also reward efforts by states that have implemented revenue-raising and asset management policies, and have undertaken investments to preserve those elements of these national systems that are located within their boundaries. A significant level of federal support for system preservation would be guaranteed for all states under this formula. The funds would flow directly to states on a mode-neutral basis for the purpose of preserving and enhancing elements of existing transportation systems—including roads and freight and passenger rail—that play a role in connecting the nation. This will require a methodical redefini-

tion of what comprises this federal system, to ensure that included facilities are truly in the national interest. Private infrastructure would be eligible for federal funds provided a compelling justification exists on the basis of public benefits and provided there is an appropriate private match. States would work with U.S. DOT to prioritize activities in line with national goals and track how well their expenditures of federal funds are performing. States could be eligible for supplemental planning funds if they use those funds to collaborate with other states.

In addition, we propose a new program, called **Sustaining Core Assets (SCA)** that would distribute funds to metropolitan areas with more than 200,000 people based on their share of gross domestic product. A regional planning entity designated by the state, typically a metropolitan planning organization (MPO), would prepare a plan that prioritizes preservation activities consistent with state plans and national goals; the same entity would also track the performance of spending under this program. As in the SConnect program, metropolitan areas could receive additional planning funds if they use those funds to collaborate across state and municipal lines in order to enhance connectivity.

NTPP recommends a third formula program to ensure that transportation remains accessible for isolated, disabled, disadvantaged, and underprivileged people in both rural and urban areas. The proposed **Essential Access Program (EAP)** would distribute funding to states based on need, as measured by numbers of people in these demographics. States would then distribute funds based on an application process that evaluates grant proposals using all of the performance metrics, weighted toward the areas that are most in need of essential access.

The chief problem with any formula program is that it fails to provide performance incentives to recipients. Although formulas offer a simple, consistent, and trans-



parent way to distribute funds, they do not address the need for accountability in meeting goals. Thus, NTPP recommends a fourth program to create proper incentives to reward performance in the use of formula funds.

The **Performance Bonus Program (PBP)** would provide additional funds to states and metropolitan regions based on their demonstrated progress toward meeting national performance goals. This would include how well they reduce their backlog of system preservation needs and optimize the performance of existing systems based on the measures in Table 1 above. Recipients could use PBP funds for any transportation purpose with few restrictions. As a corresponding corrective measure, poorly performing states and regions would be subject to greater federal scrutiny and review in the planning process for their formula funds.

NEW COMPETITIVE PROGRAMS

To keep pace with a growing and changing nation, ongoing investment in new transportation infrastructure is needed to ensure that people and goods can continue to move efficiently and in a way that is responsive to new economic, energy security, and environmental challenges. While NTPP recommends using formula programs to fund the preservation and improvement of existing national and metropolitan systems, we recommend a new approach—built on competition—for prioritizing federal investment in new capacity. This will encourage comprehensive planning for future transportation needs and assure that federal support for system expansion furthers the achievement of national goals.

Specifically, we recommend two new competitive funding programs designed to prioritize among competing proposals for federal investment in new infrastructure, which together would account for 25 percent of overall federal transportation funding. Under these programs, U.S. DOT would annually evaluate proposals using the best available data and performance measures and make recommendations to Congress, which would approve final funding on the basis of U.S. DOT's recommendations. Although there may be some controversy about U.S. DOT's ability to make funding recommendations that Congress will respect, we believe this approach can work smoothly, particularly as data quality and performance measurement techniques improve over time.

The competitive programs we propose are designed to direct federal resources (a) toward the investments that offer the greatest returns at the lowest cost, and (b) in amounts that are proportionate to the national benefits to be gained. These programs are not intended to be prescriptive, but to allow for a bottom-up approach in which states and local areas have flexibility to develop proposals that reflect their preferred strategies for advancing national goals. Thus funding could be awarded to support a variety of policies or sets of investments, including public-private partnerships across any and all transportation modes. State and local entities would have to demonstrate that these programs are cost-effective and would produce results aligned with national goals.

We call the first of these new competitive programs **Improving Federal Connections (IFC)**. It would fund the expansion of the national transportation network across modes, with a focus on all forms of freight transportation, together with investments in passenger transportation, such as intercity highway, bus, and rail links, as well as improvements to multimodal access for ports and airports. Any state, region, or locality (or collection of regional, state, or local entities) could apply for grants

to fund programs, as opposed to individual projects, that improve the performance of the overall transportation network. As already noted, U.S. DOT would evaluate applications and make funding recommendations subject to Congressional approval. All the performance metrics described previously would apply, but, consistent with the focus of this program, the national connectivity metrics would receive the greatest weight. The amount of federal funding available to any particular proposal would depend on available resources and the number of other cost-beneficial applications received. Grant recipients would be responsible for reporting on whether outcomes were achieved as predicted and states would aggregate these reports to evaluate the overall success of their programs. These evaluations would then be considered in future funding cycles.

In addition, NTPP recommends a second competitive program, called **Improving Core Transportation (ICT)**, to fund transportation-system expansion across all modes in metropolitan areas with populations greater than 500,000, with a set-aside for smaller areas. Metropolitan regions would apply for grants by submitting proposals for programs (again as opposed to projects). Programs funded using this mechanism could include a coordinated mix of public and private capital projects, operating enhancements, and other financial and administrative measures that work together to improve the overall system. As with the proposed IFC program, applications would be evaluated by U.S. DOT and funding would be approved by Congress. All performance metrics would be considered, but the metropolitan accessibility metrics would receive the greatest weight. Grants awarded under this program would be expected to focus on passenger transportation improvements, but freight improvements needed to enhance the overall performance of transportation networks in major metropolitan areas would also be eligible. As before, grant amounts would depend on benefits achieved, total resources available, and the number of other cost-

beneficial applications received. Recipients would be responsible for reporting afterwards on whether goals had been accomplished as predicted.

It is difficult to imagine that the programmatic framework for transportation that NTPP recommends can be established in the absence of significant institutional reform at all levels of government. Throughout this report we emphasize the necessity to more clearly define and articulate the federal interest in transportation. But we also aim to propose a strategy that will allow the federal government to partner more effectively with other levels of government and with the private sector.

Public sector roles and responsibilities must be reshaped and reorganized for effectively planning, funding, build-

We propose a strategy that will allow the federal government to partner more effectively with other levels of government and with the private sector.

ing, operating, and regulating the nation's transportation system. At the federal level U.S. DOT should be reorganized and better connected to other federal agencies to reflect these interests and values. The organizational structure of DOT should reflect the reorientation of transportation programs around broader national goals, by establishing modal coordinating mechanisms in the Office of the Secretary. Moreover, given the need to integrate policy considerations that go beyond the jurisdiction of traditional transportation agencies—such as energy, environment, housing, and community development—interagency coordination on these issues should also be improved.

With a few exceptions, the transportation planning processes that currently exist at the state and metropolitan levels do not support a strategic, performance-based, and accountable approach to decision-making. NTPP recommends new incentives for improved planning, including offering the carrot of additional planning funds in exchange for collaboration across modal, agency, and jurisdictional lines. This will help to shift the focus to encouraging adequate planning processes, rather than mandating specific institutional structures. We have also concluded that to the extent that current federal financial support for transportation planning is not sufficient or flexible enough to support broader planning efforts by state agencies or MPOs, it should be expanded.

Finally, the success of NTPP's reform agenda depends on data improvements. Reforms and resources will be needed to create the data collection and research capabilities that are essential to the success of a performance-based system.

Revenue and Performance

For many years the gasoline tax provided a stable and growing source of funding for federal transportation investments. The federal gas tax, however, has not kept up with growth in road use, construction costs, and system needs. As a result, the resources available in the Highway Trust Fund are increasingly falling short, which in turn has necessitated transfers from general funds. This situation is clearly unsustainable. Overall gasoline consumption is down—due first to high oil prices earlier this decade and now to the economic recession—and a combination of increased vehicle fuel-economy standards, the introduction of electric and plug-in electric hybrid vehicles, and mandated expansion of biofuels use can be expected to continue to put downward pressure on oil demand. This is obviously beneficial for many reasons, but it also leads to declining receipts from fuel taxes, assuming the level of those taxes is

unchanged. All of these developments have combined to expose flaws not only in the stability of the gas tax as a funding source, but also in its long-term sustainability.

There is widespread agreement that revenue currently collected at all levels of government is insufficient to either maintain or improve system performance. The “gap” between transportation “needs” and current investment by all levels of government ranges between \$172 billion annually to *maintain* existing infrastructure and \$214 billion annually to *improve* system performance.² Such “needs” estimates assume that it is possible to calculate an ideal level of investment—a view to which NTPP members do not subscribe. Too many factors (such as policy choices, technology, and prices) can affect the performance of the system and the “need” for capacity, making any interpretation of the term “need” itself relative and shifting. The focus should be on maximizing *valuable* investments where the returns to society are measured and optimized. Transportation investment has not traditionally been thought of in this way, but an approach that seeks to maximize returns is appropriate for allocating scarce resources. The appropriate level of overall investment is obviously important; what the federal government's share of that investment should be is, of course, a separate but also important question.

An equally fundamental concern is that existing revenue mechanisms fail to take advantage of the fact that the performance of the transportation system can be directly influenced by how users pay for it. The gas tax in the United States is very low relative to most developed countries, which means that all taxpayers subsidize the full costs of road use regardless of their contribution to system costs. This has resulted in artificially high demand and a substantial shortfall in the revenues neces-

2 National Surface Transportation Infrastructure Financing Commission. “Paying Our Way- A New Framework for Transportation Finance.” Feb. 2009. See chapter two for a detailed analysis, including various scenarios of “the widening investment gap”.

sary to cover the costs of maintaining the transportation network. Originally seen as a reasonable proxy for system use when first put in place in the 1950's, the gas tax today provides at best a weak and inaccurate price signal; few Americans are even aware of how much they pay through the fuel tax or that their contribution to system maintenance and improvement has steadily decreased over time. A recent report by the National Commission on Surface Transportation Infrastructure Financing concluded that average users pay substantially less than the full costs they impose taking into account the direct costs of wear and tear as well as indirect costs in the form of congestion, greenhouse gas emissions, and energy security impacts. An inaccurate price signal means that millions of individuals and businesses are making transportation decisions that are inefficient from a societal standpoint every day.

For all of these reasons, bold federal leadership is needed to develop, test, and implement new, more direct and more complete ways of linking revenue collection to system use and impacts. Getting the “prices right” and more directly charging users for the full cost of their use offers high economic returns, especially when charges for congestion, national security, and environmental damage are included.

Though the question of how to raise revenue has not been the primary focus of NTPP's efforts, this issue is critically important—precisely because it does ultimately relate to system performance. Thus, NTPP recommends that future efforts to address the need for new transportation revenue-raising mechanisms be guided by the following core principles:³

- Revenue currently collected at all levels of government is insufficient either to maintain or improve system performance;
- Revenue collection methodologies should be directly linked to improving system performance;
- Public revenue collection can enhance the performance of the system when users more directly understand and bear the full costs of the infrastructure they use;
- Policy-makers should address the research, standard setting, technology, privacy protection, equity and administration issues for an improved national user-pay funding mechanism, including requiring development of a time-phased implementation plan;
- The recent trend toward financing federal transportation investments with non-user-based, general taxpayer funds should be reversed; and,
- Distribution of federal revenues should promote both accountability and net increases in sustainable state and local revenue sources.

Final Word

Taken together, the recommendations outlined in this report with regard to federal goals, accountability measures, programmatic restructuring, funding approach, and revenue strategies constitute a far-reaching and bold reform agenda. We do not underestimate the difficulty of implementing this agenda. Yet we are equally convinced that the effort to bring about fundamental changes in U.S. transportation policy is not only well-justified by the large benefits that could be achieved—but is in fact necessary given the scale and urgency of the multiple transportation-related challenges the nation faces in the coming decades.

³ We note that our recommendations in this regard align closely with conclusions reached by both the National Transportation Policy and Revenue Study Commission and the National Surface Transportation Infrastructure Financing Commission.

Summary of Recommendations

I. Center the national transportation system around five over-arching goals:

- a. Economic Growth
- b. National Connectivity
- c. Metropolitan Accessibility
- d. Energy Security and Environmental Protection
- e. Safety

II. Align programs and federal funds to progress on a suite of metrics linked to national goals:

- a. Access to jobs and labor
- b. Access to non-work activities
- c. Network utility
- d. Corridor congestion
- e. Petroleum consumption
- f. CO₂ emissions
- g. Fatalities and injuries per capita
- h. Fatalities and injuries per Vehicle Miles Traveled (VMT)

III. Consolidate current federal programs into two categories:

- **Formula-Based System Preservation Programs and**
- **Competitive Capacity Expansion Programs**

a. Merge formula programs into three preservation programs plus a bonus program that together comprise 75% of total funding:

- i. **Sustaining National Connectivity (SConnect)** – to preserve the existing national system
- ii. **Sustaining Core Assets (SCA)** – to preserve existing metropolitan systems
- iii. **Essential Access Program (EAP)** – to provide transportation access for rural areas, the disabled, and the economically disadvantaged
- iv. **Performance Bonus Program (PBP)** – to reward superior programmatic goal alignments in the other three formula programs

b. Merge competitive programs into two new multi-modal competitive capacity expansion grant programs together comprising 25% of total funding:

- i. **Improving Federal Connections (IFC)** – to expand capacity in the national system
- ii. **Improving Core Transportation (ICT)** – to expand capacity in metropolitan areas

IV. Address key enabling measures for the above reforms:

a. Research/Policy Refinement

- i. **Develop Data And Metrics** – New and targeted federal research programs to improve transportation data and performance measurement
- ii. **Redefine National System** – Developing a new consensus that redefines what is meant by the federal transportation system through the establishment of a bipartisan commission

b. Institutionalize Alignment

- i. **Focus Dot Organization** – Start organizing the U.S Department of Transportation around national goals by establishing modal coordinating mechanisms within the Office of the Secretary
- ii. **Institutional Dynamic Interagency Coordination** – Establishment of federal interagency mechanisms to coordinate transportation policy with housing, community development, energy, and environmental protection
- iii. **Revitalize Planning** – Conditioning supplemental planning funds on a revitalized transportation planning process

c. Performance-Based Pricing

- i. **Link New Revenue To Performance** – We recognize that additional funds are needed to address vital national interests in transportation, and recommend that new revenues should be user-based and applied to performance-based programs
- ii. **Plan For National User-Fee** – Due to the many benefits of a comprehensive national user-based funding mechanism, NTPP recommends a national commitment to completing the needed research and planning to transition to a national user-pay funding mechanism by a date certain
- iii. **Institute New Mode-Neutral Freight Fee** – NTPP recommends development of a mode-neutral freight fee to fund the needed new focus on critical freight infrastructure
- iv. **Implement And Apply Carbon Pricing** – New climate policies and transportation legislation need to assure that transportation users cover the full costs of their carbon emissions – and that carbon pricing revenue support investments to significantly reduce carbon emissions.
- v. **Support State Funding Flexibilities** – Federal policies and funding should assist states and local governments in developing sustainable funding sources including eliminating federal restrictions on road pricing, supporting efforts by states to implement direct user charges and expanding TIFIA credit support.



Fundamental reform is needed.
The alternative is to allow America's transportation systems to continue to fall short of meeting the multi-faceted demands increasingly being placed on them—with collective costs to the economy, our quality of life, and the environment that can only grow over time.





I. Introduction

Since the founding of the American republic, a robust transportation system has been essential to the cohesion, security, and economic prosperity of this large and diverse nation. The federal government's role in transportation is grounded in Article 8 of the U.S. Constitution, which states that "Congress shall have power to regulate commerce with foreign nations, and among the several states." Over the course of more than two centuries, federal involvement has been central to the creation of a vast continent-wide network of canals and railroads, interstate highways, and airports. As that network evolved and expanded, public investments in transportation came to be seen as serving values and objectives well beyond merely facilitating interstate commerce—among them economic growth and competitiveness, regional connectivity, public safety, equity, and national security.

Today, these core values and objectives remain as important as ever, but the nation's transportation infrastructure is worn, dated, strained to capacity, and widely viewed as inadequate to meet the demands and challenges of a new century. Federal transportation policies and programs have proliferated in an attempt to keep up with changing priorities, but have not been substantially reformed since the 1950s. The inevitable result has been a loss of direction and clear sense of purpose, and a growing disconnect between planning and investment decisions and broader societal priorities and objectives. *Existing funding mechanisms are inadequate to maintain existing infrastructure, let alone to provide for the new capacity and modernizing improvements needed*

to serve a growing population and to remain competitive in an increasingly globalized world economy. In this context, growing support can be found for the proposition that fundamental reform is needed. The alternative is to allow America's transportation systems to continue to fall short of meeting the multi-faceted demands increasingly being placed on them—with collective costs to the economy, our quality of life, and the environment that can only grow over time.

Recognizing the need for a new vision for federal transportation policy, the National Transportation Policy Project (NTPP) was among the first projects launched by the Bipartisan Policy Center (BPC) after the Center's inception in June 2007.⁴ In line with the BPC's overarching purpose, which is to develop and advance pragmatic, politically viable solutions to critical public policy problems, NTPP was designed to bring new approaches and fresh thinking to our nation's pressing transportation challenges. The Project's membership includes experts and leaders in transportation policy, as well as users of the system whose voices have not typically been heard in previous policy debates. NTPP is chaired by four former elected officials—two Republicans and two Democrats—who served at the federal, state, and local levels and who have a wide range of interests and experience in public policy and management. The NTPP

⁴ The BPC was founded by former Senate majority leaders Howard Baker, George Mitchell, Tom Daschle, and Bob Dole and builds on a model for principled bipartisan cooperation and compromise first pioneered by the National Commission on Energy Policy. For more information on the BPC and on its other projects in the areas of energy, national security, and health care please visit www.bipartisanpolicy.org.

participants are not “stakeholders” in the sense that they have an interest in maintaining the *status quo* in transportation policy and programs. Rather, their interest is in improving the performance of U.S. transportation systems and reforming national policy to meet the challenges of a new era. (A full list of NTPP members is provided on the opening pages of this report.)

U.S. transportation policy needs to be more performance-driven, more directly linked to a set of clearly articulated goals, and more accountable for results.

A shared view of these challenges—and of their relevance to the nation’s continued prosperity—necessarily frames and motivates any endeavor to find solutions. NTPP participants agreed early on that a U.S. transportation policy for the 21st century must address the following:

- Assuring that the nation’s transportation networks are robust and flexible enough to provide for the efficient movement of people and goods while handling growing demands on our ports, trade corridors, and urban centers.
- Implementing effective strategies for addressing the growing transportation problems in our major metropolitan areas, which cost Americans countless millions of productive hours on a daily basis.

- Addressing our continued and still growing dependence on petroleum as America’s primary transport fuel—and the economic and geopolitical insecurity that comes with this dependence
- Dramatically reducing the transportation sector’s contribution to global climate change.
- Confronting still unacceptable levels of mortality and injury on the nation’s highways.
- Finally, running through all of these issues is the notion of equity; the proposition that no one should be excluded from the economic benefits brought about by transportation systems.

This report advocates a new approach to national transportation policy aimed at responding more effectively to these challenges. It offers a number of specific recommendations based on findings and conclusions developed by NTPP participants over the course of multiple meetings and discussions during the last year and a half. These discussions were informed by sponsored research on specific aspects of the policy challenge, listed in Appendix C.⁵ The vision we articulate incorporates policy and programmatic changes, institutional reforms at all levels of government, and a redefinition of the federal role in the financing and operation of the nation’s transportation systems. At its core, however, our proposal rests on a relatively simple proposition: *that U.S. transportation policy needs to be more performance-driven, more directly linked to a set of clearly articulated goals, and more accountable for results.*

As sensible as it sounds, actually adopting a goal-driven and results-oriented approach to transportation policy would constitute a surprisingly radical change from

⁵ This research will be made publicly available over the next year.



- Chapter V describes specific performance measures for evaluating progress toward national goals
- Chapter VI discusses NTPP's specific recommendations for reforming the current federal transportation program structure and for addressing other critical issues with respect to financing mechanisms, institutional reform, and data collection

the status quo.⁶ Indeed, we anticipate that many of the changes and reforms we propose will be difficult to implement, not least because some of them are likely to face strong opposition from those with stakes in current institutional and programmatic arrangements. Nevertheless, comprehensive structural reforms such as those we recommend are necessary in the long term to serve the economic, social, environmental, and national security interests of 21st century America.

The remainder of this document is structured as follows:

- Chapter II describes NTPP's general approach to transportation policy reform and articulates a set of guiding principles
- Chapter III provides context by describing key features and shortcomings of the nation's existing policies and programs
- Chapter IV identifies and discusses five proposed national goals for U.S. transportation policy

6 Government Accountability Office. "Surface Transportation Programs: Proposals Highlight Key Issues and Challenges in Restructuring the Programs." July 2009. GAO-08-843R





II

II. Principles for a New Approach to U.S. Transportation Policy

Several core principles, identified early in the project, helped organize NTPP's efforts to develop a new approach to U.S. transportation policy. These principles are worth reviewing at the outset, not only because they infuse all of the analysis and recommendations that follow, but because they help to highlight the most important gaps and shortcomings in the current situation:

- The need for a distinct federal role in transportation policy, with clearly defined national interests and priorities to guide federal involvement,
- A federal policy that directly promotes performance and builds in clear accountability measures,

- A mode-neutral approach that optimizes performance across the entire system, and
- The full integration of national energy and environmental goals with national transportation policies, investments, and decisions.

The remaining sections of this chapter discuss each of these principles, and why they are relevant in light of the new challenges that confront U.S. transportation policy today.

A Bold New Blueprint for Transportation Policy in the UK: The Eddington Report

A similar effort to develop reform proposals for transportation policy “across the pond” had an important influence on the NTPP’s work. In a report submitted to the UK government in December 2006, Sir Rod Eddington articulated a long-range strategic vision for transportation that included a dramatic refocusing of the national government’s role in meeting the need for greater flexibility and mobility in a modern economy and society. Presaging many of the themes expressed throughout this report, Eddington concluded that it is the role of government to identify objectives, to take a cross-modal approach to finding the best ways to attain those objectives, to consider all types of “interventions,” and to prioritize the options which do the most to deliver on those objectives. Eddington emphasized that all efforts to advance broadly held transportation goals will be greatly facilitated by “getting the prices right,” which means calibrating user payments to the full cost of providing and maintaining the system. Subsequent chapters of this report explore in more detail how these same aspirations might be applied in practice in the U.S. context.

Need for a Clearly Defined Federal Role

NTPP participants believe that because of the inherently national nature of the challenges outlined in the introduction—economic prosperity, competitiveness, energy dependence, climate change, safety, and equity—federal clarity and leadership in the realm of transportation policy are not only important, but indispensable. Unfortunately, current federal policy is a patchwork, cobbled together over the course of several decades, with little regard to modal integra-

A critical role for federal policy—and for the deployment of federal funds—is not only to support programs that advance specific national interests, but to stimulate and support state and local investments, innovations, and initiatives that are consistent with national goals and values.

tion or modern realities.⁷ At the same time, the use of federal funding for nearly every aspect of transportation has muddled the role of states, local governments, and broader regional interests in defining and funding their own transportation needs, and this confusion has often produced perverse incentives.⁸ Throughout this report, as we seek to define and articulate the federal interest in

7 Government Accountability Office. "Surface Transportation – Restructured Federal Approach Needed for More Focused, Performance-Based, and Sustainable Programs." Mar. 2008. GAO-08-400. <http://www.gao.gov/new.items/d08400.pdf>

8 Government Accountability Office. "Surface Transportation: Clear Federal Role and Criteria-Based Selection Process Could Improve Three National and Regional Infrastructure Programs." Feb. 2009. GAO-09-219

transportation, we also aim to hone our understanding of the appropriate federal role and to propose a strategy that will allow the federal government to partner more effectively with other levels of government and with the private sector.

In almost all cases, of course, federal investments in transportation also provide local and regional benefits—suggesting there is an appropriate role for leadership and resource commitments at other levels of government. Moreover, local control over transportation investments has many benefits and a new, more focused national program must not undermine those incentives or benefits. In the future states and localities will have to rely more on their own sources of revenue for many transportation investments even when partnering with the federal government. Thus, a critical role for federal policy—and for the deployment of federal funds—is not only to support programs that advance specific national interests, but to stimulate and support state and local investments, innovations, and initiatives that are consistent with national goals and values. We return to this issue of a more effective partnership between the federal government and other actors in subsequent chapters.

A more clearly defined federal role also requires that we address the excessive proliferation of federal transportation programs. A study conducted in 2007 by the National Surface Transportation Policy Study and Revenue Commission (hereafter "National Transportation Policy Commission") identified 108 different programs that are being administered by the federal Department of Transportation (U.S. DOT) under various legislative requirements.⁹ This proliferation of federal programs is perhaps unsurprising, given the incremental way transportation policy and spending have evolved since

9 National Surface Transportation Policy Study and Revenue Commission. "Transportation for Tomorrow." 2007.



1956, but it clearly reflects—and by itself *contributes to*—a lack of clarity about overarching national goals. Implementing a more integrated and performance-oriented approach necessarily requires consolidating and streamlining existing programs (the National Transportation Policy Commission, for example, has proposed consolidating existing initiatives into ten programs).¹⁰ NTPP agrees in principle, though we also recognize that it is often politically difficult—and in some cases poor policy—to eliminate programs, particularly when they aim to advance a worthy objective or have the support of a committed constituency. Accordingly, our approach is designed not only to reduce the number of programs, but to consolidate and organize them in a way that reflects a clearly articulated and comprehensive set of widely shared objectives.

Performance and Accountability

As already noted in the Introduction, a distinguishing feature of the NTPP's approach is a new focus on goals, performance, and accountability in U.S. transportation policy.¹¹ This is particularly important in the context of

severely constrained resources. At present, the country faces not only a shortfall in identified revenues for needed transportation investments, but a larger economic and fiscal crisis. Given that there are simply not—and will never be—enough resources to do everything in all places, priority must be given to assuring that all funds, whatever their sources, are targeted to programs and projects that will produce the greatest benefits. In light of all of the challenges facing the nation it will be very difficult to secure additional resources committed to transportation, particularly if expenditures cannot be directly linked to measurable returns.

As we have emphasized repeatedly, the single most critical flaw in our existing national surface transportation policies and programs is the absence of clear, overarching, consensus-based goals. Since the era of interstate highway construction over a half century ago, this lack of defined goals has undermined federal efforts to keep pace with changing transportation needs and to promote the more effective management and maintenance of infrastructure critical to national interests. Absent clear goals, it is not surprising that the current system of transportation planning and funding, at all levels of government, lacks accountability. This has been a common theme of reviews by many stakeholders—and was pointedly summed up in a recent report by the Government Accountability Office (GAO) that criticized existing programs for lacking a well-defined national vision, having no links to performance, and not addressing current challenges with respect to either congestion or freight demand.¹²

The problem of accountability stems in part from a well-intended effort to provide the states, which are the primary recipients of most federal transportation funds, with extensive flexibility to shift federal dollars to any

10 National Surface Transportation Policy Study and Revenue Commission. "Transportation for Tomorrow." 2007.

11 See also: 1) T4America. "Platform for the National Transportation Program Authorization." <http://t4america.org/platform>. 2) Building America's Future. <http://www.investininfrastructure.org/agenda>. 3) The National Chamber Foundation. "The Transportation Challenge – Moving the U.S. Economy." Apr. 2008. <http://www.uschamber.com/publications/reports/0804transportationchallenge>.

12 Government Accountability Office. "Surface Transportation: Principles Can Guide Efforts to Restructure and Fund Federal Programs." July 2008. GAO-08-744T.

“Title 23” or federally eligible road or project. The current structure amounts to a de facto block grant program. While an extensive Federal Highway Administration (FHWA) field structure is present in every state, the federal oversight is process-oriented and focused on the front end. This means little attention is given to the outcome or impact of individual investments. What federal oversight exists in terms of eligibility requirements for highway projects is often criticized as adding considerable cost and time; the potential benefits of increased oversight are rarely considered.¹³

In fact, it may be surprising to learn that there is no current federal requirement to optimize any “return” on transportation investments, or even to estimate the potential returns or cost-effectiveness of alternate investments in most cases. Formula funds, which constitute the bulk of federal funding, contain no requirement that grant recipients focus on results or even consider economic analyses of project costs or benefits. This simple mechanism for transferring funds had merit during the interstate construction years, when a national system had been agreed upon. But today there is no agreed-upon national plan. Recent research has documented that, since the completion of the Interstate Highway System, the returns on public highway investments have seen returns to single digits,¹⁴ due in part to inefficient policies either to promote sound management of existing infrastructure or to maximize the returns from new investments.

A further challenge to strategic performance-driven investments is the limited capacity for informed decision-making and institutional collaboration. The require-

ment that all projects be contained in transportation improvement programs (TIPs), prepared and approved by metropolitan planning organizations (MPOs) and then combined into state TIPs (STIPs) has in most cases resulted in lists of projects rather than in a strategic and comprehensive approach to overall system investment. The lack of accountability extends to states and metropolitan regions that likewise have never been asked to track the results of their investments of federal, state, and local funds.¹⁵

Closely related to these issues of institutional structure and capacity is the need for better data: Simply put, a performance-based system cannot exist without reliable and consistent information on critical aspects of system performance. Unfortunately, the reverse tends also to be true—that is, agencies are unlikely to invest in data collection absent a requirement to demonstrate results. Thus a central element of our recommendations concerns institutional requirements for the development of timely and reliable performance data at the local, state, and federal levels.

Mode Neutrality

Transportation programs and policies have long been characterized by modal “stove-pipes” and distinct interests. Despite efforts in recent surface transportation bills—one of which even featured the word “inter-modal” in its title—to reconcile these varying interests and introduce “flexibility” in the use of various funding streams, many transportation policy discussions continue to be dominated by endless debates about what is more subsidized or disadvantaged: highways vs. transit, trucks vs. rail, and passengers vs. freight. In fact, the

13 Government Accountability Office. “Federal-Aid Highways, Federal Requirements for Highways May Influence Funding Decisions and Create Challenges, but Benefits and Costs Are Not Tracked.” Dec. 2008. GAO-09-36. p.4. <http://www.gao.gov/new.items/d0936.pdf>

14 Shirley, Chad and Winston, Clifford, Firm Inventory Behavior and the Returns from Highway Infrastructure Investments, *Journal of Urban Economics*, Volume 55, Issue 2, March 2004, pp. 398-415.

15 The provision of federal law that has been most effective and meaningful in the development of TIPs (since adopted in the Intermodal Surface Transportation Efficiency Act of 1991 or ISTEA) has been the requirement that TIPs and the projects contained within them must be “fiscally constrained,” that is, that the recipients of federal surface transportation grants must establish that adequate funds are available to complete the projects and to implement the TIP.

major “surface transportation” bills still do not cover intercity passenger rail, do not (for the most part) explicitly deal with freight, and have only recently included public transit. The fact that it remains difficult if not impossible to plan for and optimize across different modes constitutes a major barrier to maximizing returns from current transportation investments. Dramatic restructuring is needed to surmount this barrier so that decision makers can focus on finding the most cost-effective solutions to identified problems at the metropolitan, state, and corridor levels.

The current decision-making process is compartmentalized by transportation mode—often with separate rules, procedures, and eligibility requirements for each mode—and is not driven by economic analysis.¹⁶ By their very nature these disconnected funding streams discourage comprehensive strategies to address transportation problems in a way that would most improve the performance of the overall system.¹⁷

While individual NTPP members may be convinced of the relative promise of particular transport options or strategies, we agree that no particular mode represents the best solution to all problems in all situations. A holistic approach to transportation investments is of particular importance in the context of severe resource constraints, which limit the ability to fund all competing demands. This suggests that public investments, whether federal, state, or local, should be **programmatic in scope** rather than project—or mode—specific. In sum, mode-neutral programs, which are designed to prioritize projects on the basis of cost-effectiveness and to enhance connections across different modes, hold the most promise for improving system performance for all users.

16 Government Accountability Office. “Surface Transportation, Strategies Are Available for Making Existing Road Infrastructure Perform Better.” July 2007. GAO-07-920. p.44. <http://www.gao.gov/new.items/d07920.pdf>

17 Congressional Budget Office, “Freight Rail Transportation, Long Term Issues”, 2006, <http://cbo.gov/ftpdocs/70xx/doc7021/01-17-Rail.pdf>

Integrating Energy and Environmental Goals

Awareness of the environmental and energy security dimensions of transportation is not new, but in the past, these concerns have largely been addressed outside of transportation policy, often through separate policies targeted to regulating vehicle or fuel characteristics. Examples of existing policies that have a direct connection to transportation range from vehicle fuel economy standards to biofuels mandates, and from planning requirements to various funding programs. Unfortunately,

No particular mode represents the best solution to all problems in all situations.

these policies are generally not considered as part of an integrated transportation strategy, but instead are often developed, debated, and implemented by energy, environmental, or even agricultural authorities and stakeholders. To the extent that transportation planners use environmentally-oriented tools it is most often to mitigate specific project-oriented problems rather than to address national-level concerns or objectives (existing mechanisms for resolving local environmental concerns in the context of most transportation projects are summarized in the next chapter).

Broader energy- and environmental-policy objectives must be integrated in the development of comprehensive, performance-based programs at the regional/corridor, state and local levels and should directly inform the choice of specific transportation strategies and investments. We focus on two issues in particular—oil dependence and climate change—as being especially important from a national (and indeed, global) perspective and as having the potential to exert a profound effect on the future evolution of America’s transportation systems. This is no way implies that we should ignore

other environmental impacts, and we do suggest ways of integrating these other impacts as well.

Oil dependence re-emerged as a major national policy issue in recent years as a dramatic run-up in world oil prices earlier this decade coincided with growing concerns about future global supply adequacy. The issue has receded somewhat in recent months as the global

Broader energy- and environmental-policy objectives must be integrated in the development of comprehensive, performance-based programs

economic crisis led to a worldwide fall-off in demand and prices, but energy security generally—and oil dependence in particular—are likely to return as significant issues when global consumption begins to trend upward again. Here it is worth acknowledging that oil has been an essential enabler of transportation for many decades, and will continue to play an important role in the energy mix for years to come. Indeed, its historic abundance and generally low cost have delivered immense benefits to individuals and the nation.

But while domestic oil production remains considerable—and valuable to the economy for multiple reasons—America's dependence on foreign sources continues to be a source of concern, particularly since a large share of global production capacity is under the jurisdiction of political regimes that are unstable, hostile to the interests of the United States, or both.¹⁸ In 2007, oil imports totaled nearly \$319 billion—in fact, oil accounted for 14 percent of the total value of *all* imports

to the United States that year¹⁹—and oil has long been a major contributor to the nation's chronic balance of trade deficits. More broadly, dependence on oil as the primary fuel source for America's transport sector inevitably exposes the national economy to dramatic price swings in world oil markets and long-term global supply concerns, creating a major source of insecurity that has geopolitical and military, as well as economic dimensions. As the National Commission on Energy Policy [NCEP] and others have pointed out, oil is fundamentally a global commodity—thus, "U.S. exposure to world oil price shocks is a function of the amount of oil it consumes and is not significantly affected by the ratio of domestic to imported product."²⁰ In any case, a variety of policies have been introduced in an effort to reduce oil consumption in the U.S. transport sector. The failure to integrate these policies with transportation policies means that cost-effective opportunities for leveraging these different sets of objectives to achieve maximum societal benefits are almost certainly going untapped.

The disconnect between transportation and climate policy, meanwhile, represents another source of missed opportunities that must be remedied, especially in light of the shortage of public resources available for dealing with these issues and the magnitude of the risks involved. In fact, of all transportation-related environmental concerns, climate change is likely to dominate for much of this century, given its far-reaching impacts and given that the U.S. transport sector is a major contributor to the global problem. As with the energy security concerns discussed above, the transport sector's climate liabilities are directly related to petroleum fuel consumption. Oil use for transportation accounts for a large share—approximately one-third—of overall U.S. energy-related greenhouse gas emissions. In fact,

18 See, e.g., Energy Security Leadership Council. "A National Strategy for Energy Security: Recommendations to the Nation on Reducing U.S. Oil Dependence." Sep. 2008. <http://www.secureenergy.org>

19 Calculated using figures from the U.S. Bureau of Economic Analysis. "FT900: U.S. International Trade in Goods and Services." June 10, 2008. <http://www.census.gov/foreign-trade/Press-Release/2008pr/04/ft900.pdf>

20 National Commission on Energy Policy. "Ending the Energy Stalemate, A Bipartisan Strategy to Meet America's Energy Challenges." Dec. 2004.

the transport sector's contribution to national emissions is second only to that from electricity production.²¹

Within the transport sector, surface transportation—that is, cars, trucks, buses, and rail—accounts for about 86 percent of carbon emissions.²²

Since the vast majority of transport-sector carbon emissions are the direct result of oil combustion, most policies aimed at reducing transportation petroleum fuel use are consistent with the aim of reducing climate liabilities—an important potential exception being policies that promote the use of alternative fossil-based sources of petroleum (such as coal-to-oil, oil sands, or tar shales) that are substantially more carbon-intensive than conventional petroleum fuel. As we have already noted, however, most existing policies for reducing transport-sector emissions and energy use attempt to address vehicle performance, especially fuel economy, and fuel mix (in the U.S. case, primarily by promoting biofuels). Thus there has been little systematic effort to take advantage of carbon reductions available through transportation policies that promote reduced travel or the use of more efficient modes and travel alternatives.

At a national level, one of the most important measures available for integrating energy, environment, and transportation objectives is proper pricing. With a more accurate price signal to reflect the true cost of transportation, people will make more informed decisions about their transportation choices, altering everything from home and vehicle purchases to commuting habits. More accurate pricing policies should, at a minimum, include the environmental, construction and maintenance, and congestion costs of travel. As the UK Eddington Report notes, the transport sector needs to “play an impor-

tant role in an economy-wide response” to the climate change challenge. It goes on to argue that transportation “should meet its full environmental costs,” and that “getting the environmental prices right across all modes makes strong economic as well as environmental sense.”²³

Various proposals to address the pricing issue include a cap-and-trade program to limit greenhouse gas emissions or a carbon tax. Either would represent an important policy advance for the transportation sector, but at the level of policy stringency likely to be politically viable in the United States a carbon price increase alone would be unlikely to cause a large shift in transportation technology, travel demand, or patterns of infrastructure investment. Indeed, under the most prominent recent proposals for national climate legislation—nearly all of which call for a cap-and-trade system to limit greenhouse gas emissions—the expected impact on gasoline prices amounts to less than 35 cents per gallon by 2030.²⁴ As NCEP has observed, this level of price signal alone “would be expected to produce very little improvement in the fuel efficiency of passenger cars and very little reduction in vehicle-miles traveled.”²⁵ Adding in additional costs for congestion, construction, and maintenance would result in a stronger price signal and commensurately larger impacts, but the overall effect might still be small relative to the kinds of price swings that the market itself—independent of any targeted policy intervention—has produced in recent years.

21 U.S. Environmental Protection Agency. “Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2007.” April 2009. <http://www.epa.gov/climatechange/emissions/usinventoryreport.html>

22 U.S. Environmental Protection Agency. “Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2007.” April 2009. <http://www.epa.gov/climatechange/emissions/usinventoryreport.html>

23 United Kingdom Department for Transport. “The Eddington Transport Study: The Case for Action.” 2006. pp. 5-6.

24 Environmental Protection Agency. Analysis of Wasman-Markey draft legislation.

25 National Commission on Energy Policy. “Ending the Energy Stalemate, A Bipartisan Strategy to Meet America’s Energy Challenges.” Dec. 2004.



Understanding where we now stand and how we got here is essential, in the view of NTPB members, to charting a path forward that successfully draws on the most important lessons of the past.





III

III. U.S. Transportation Policy Today

Ironically, the issues that have emerged as central challenges for U.S. transportation policy in the 21st century reflect in large part the immense success of the nation's last great public works and transportation initiative: the interstate highway system. Launched in the 1950s, the interstate highways, the secondary roads and regional arterials that grew up around them, and the vehicles that traveled on them supported a half-century of strong economic growth and delivered unprecedented levels of mobility to the average citizen. But the interstate highway system also fostered patterns of low-density development that placed ever greater demands on land, water, and air resources and led to a steadily increasing dependence on petroleum—with all the energy and national security, as well as environmental liabilities, that dependence entails. More recently the rise of a national economy centered in growing, spreading, and often converging major metropolitan regions has dramatically altered the American landscape and created new transportation needs.

This chapter describes the evolution of U.S. transportation policy since the interstate highway era and highlights several features of the current federal program and policy structure, including past attempts at performance-based programs. It is intended to provide context for the further analysis and recommendations that follow in subsequent chapters. Understanding where we now stand and how we got here is essential, in the view of NTPP members, to charting a path forward that successfully draws on the most important lessons of the past.

How We Got Here: A Brief History of U.S. Transportation Policy

The interstate highway era began with the first Federal Highway Act, which was enacted in 1938, and set in motion a study to examine the possibility of building new “superhighways” across the country.²⁶ However, the federal-aid highway program structure—most of which remains in place today—was established nearly two decades later, by the Federal-Aid Highway Act of 1956. Although Congress has since passed more than twenty pieces of legislation reauthorizing federal surface transportation programs, essential elements of the 1956 Act continue to guide federal policy today.

For example, the 1956 legislation called for the federal government to provide 90 percent of the funding for the construction of the Interstate Highway System. The system itself would be constructed and owned by individual states, which had to provide the remaining 10 percent of funding. In addition, states had to follow the network plan laid out by the federal government and conform to federal design standards. The federal share of highway funding is now typically less than 90 percent on federal-aid projects (it is 80 percent in most cases), but the basic structure remains.

The financing mechanism used to construct the Interstate Highway System—a Highway Trust Fund (HTF)

²⁶ Mertz, Lee. “Origins of the Interstate.” Federal Highway Administration. 2002. Washington, DC. <http://www.fhwa.dot.gov/infrastructure/origin.htm>

supported by revenues from a federal tax on gasoline and diesel fuel—is also still in place. In effect, the HTF taxed users of the existing road network to pay for the construction of a new system. Given the dominance of gasoline and diesel-powered vehicles as a primary means of transport, the HTF ensured that there would be ample funding for what was at the time the largest public works project in American history.

Finally, the 1956 act set the tone for how federal highway funds would be distributed over the next fifty years. It created a formula for distributing funds based on population, land area, and road miles. This changed in 1960 to a pure “cost-to-complete” structure,²⁷ but the basic distributive principle remains. That is, the federal government distributes funds to states for the specific purpose of building particular projects—originally the Interstate Highway System. When transit projects and funding were later folded into the highway legislation, they followed a similar top-down model.

The 1956 legislation responded to a clear need—it would have been extremely difficult, if not impossible, to construct such a large system on a state-by-state basis—and it was supported by a large and diverse coalition that included automobile manufacturers, oil companies, planners, civil engineers, builders, laborers, real estate developers, and a wide range of business interests.²⁸ Subsequent federal transportation bills, while they introduced some important modifications, have been incremental in nature and have, over time, lost the clarity of purpose that characterized the 1956 Act.

Some of the most consequential changes to federal transportation policy occurred in 1991 when Congress passed the Intermodal Surface Transportation Effi-

ciency Act (ISTEA). ISTEA was the first transportation bill of the post-interstate era. It attempted to integrate public transit into the federal policy framework, significantly increased state and regional control over the distribution of federal funds among eligible programs (for example, states could use federal funds to address goals like mitigating congestion and meeting air quality standards), and strengthened the state and local role in transportation planning. ISTEA also broadened the range of eligible projects that could be funded to meet local highway and transit needs.

The result is a federal program that is larger than ever in terms of size, legislative complexity, and regulation, but still lacks a clear and distinct purpose.

The next major surface transportation bill, the Transportation Equity Act for the 21st Century (TEA-21, enacted in 1998) maintained the core ISTEA framework, but added new programs and increased the minimum share of federal fuel tax revenues guaranteed to be returned to individual states (known as the “Minimum Guarantee”).²⁹ TEA-21 expanded what was eligible for federal assistance and the concept of the federal role in transportation. It did not eliminate any of the programs created by ISTEA. Instead it simply added new categories to the eligible uses of transportation funds, further diffusing any sense of federal purpose in the name of flexibility and local responsibility.

Unfortunately, the latest renewal (and the one under which we are currently operating) has further confused and obscured the federal role. The Safe Accountable Flexible Transportation Equity Act—A Legacy for Users

27 Weingroff, Richard. “Creating the Interstate System.” *Public Roads*. 1996, Volume 60, No. 1.

28 Rose, Mark. “Interstate: Express Highway Politics, 1939-1989, Revised Edition.” The University of Tennessee Press/Knoxville. 1990.

29 Smallen, David. “TEA-21: An Historic Piece of Legislation.” *Public Roads*. 1998, Volume 62, No. 2.

(SAFETEA—LU, enacted in 2005) made virtually no major changes to existing programs. It did, however, reconfigure the Minimum Guarantee program as an “Equity Bonus” program and increased to 92 percent the minimum share of fuel tax revenues returned to all states by the last year of the bill. SAFETEA—LU also added several new programs, many of which were fully earmarked—indeed, this bill shattered the record number of earmarks included in previous surface transportation bills by a large margin. The result is a federal program that is larger than ever in terms of size, legislative complexity, and regulation, but still lacks a clear and distinct purpose.

During the same period, federal policies for other modes of surface transportation remained outside the TEA framework. Intercity passenger rail, for example, continues to be addressed in separate authorization bills, despite many parallels to the federal role with respect to highways. Intercity passenger rail has also been operating under an outdated paradigm for many years. As part of a strategy to prevent the collapse of the nation’s railroads, the federal government took over their passenger operations, which were unprofitable, allowing the remaining railroads to focus on shipping freight. Amtrak was created in 1971 to consolidate national passenger rail service, and was given exclusive rights to operate over freight railroad property at the insistence of those railroads.³⁰ It has proved as impossible for Amtrak as it was for the private railroads to provide financially viable national passenger rail service or even to attract sufficient resources to maintain and operate their existing system. Amtrak has often been forced to incur debt and defer maintenance on its own infrastructure. The result has been a chronic and negatively reinforcing cycle of dependence on Congressional appropriations. Meanwhile, despite several attempts, there has never

30 Freight railroads did not, and still do not, like passenger rail operating on their tracks, but as a second best option they prefer only one passenger railroad instead of many.

been a successful effort to reform the nation’s passenger rail policy or to integrate it with broader transportation policies and objectives.³¹

If federal policy on highways, transit, and passenger rail seems stuck in another era, at least these modes have a policy. By contrast, there has been little coherent and ongoing federal policy involvement in freight transport (except to the extent that federal highway

There has been little coherent and ongoing federal policy involvement in freight transport

policy has relevance for the trucking industry)—despite the enormous economic significance efficient freight transport has for the nation. As a result, system performance is declining even as international trade flows grow. Diverse stakeholders have called for national legislation to address freight transport issues but so far federal leadership has been inadequate. More broadly, and as we noted in the previous chapter, there has been little effort to create an integrated federal policy across all modes of transportation. Such a policy will only result from a broad coalition in support of reform for the modern era, but that coalition has yet to emerge. In the meantime, we are left with a transportation policy that, at its core, is focused on individual modes. It is therefore ill-equipped to deal with challenges—including challenges like globalization, energy security, climate change, and chronic congestion—that did not exist, or were not as severe, when the Interstate Highway System was designed and the current framework for federal policy was devised.³²

31 Congressional Budget Office. “The Past and Future of U.S. Passenger Rail Service.” Sep. 2003. <http://www.cbo.gov/ftpdocs/45xx/doc4571/09-26-PassengerRail.pdf>

32 Springer, Darren and Greg Dierkers. “An Infrastructure Vision for the 21st Century – Strengthening Our Infrastructure for a Sustainable Future.” National Governors Association Center for Best Practices. 2008.

Current Policy and Key National Interests

Below we briefly explore current funding challenges and spending challenges. Then we move into an examination of how well our current federal transportation programs advance key national interests in economic growth, including national connectivity and metropolitan transportation, environmental protection and public safety.

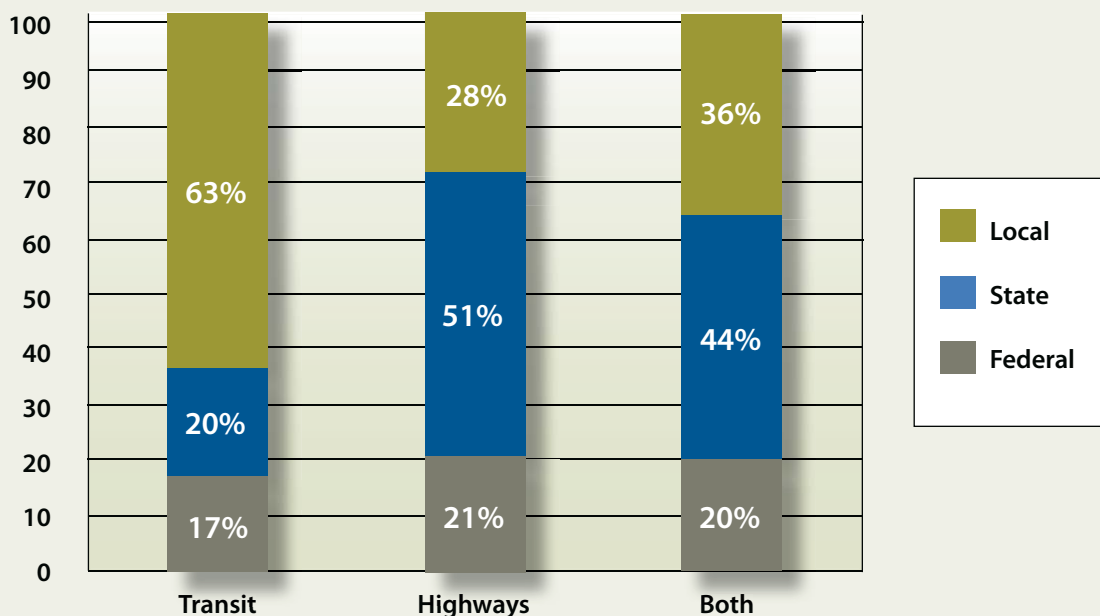
FUNDING CHALLENGES

In light of the fact that the federal role in transportation—both in terms of the number of federal programs and the level of federal expenditures—is larger than at any previous point in the nation’s history, the widespread perception that America is currently underinvesting in its transportation infrastructure might seem surprising. Many reports have tried to quantify this

shortfall. For example, a recent report of the National Surface Transportation Infrastructure Financing Commission (Financing Commission) estimated that the gap between transportation “needs” and current investment by all levels of government ranges between \$172 billion annually to maintain existing infrastructure and \$214 billion annually to improve system performance.³³ Of course, such “needs” estimates assume that it is possible to calculate an ideal level of investment—a view to which NTPP members do not subscribe. Too many factors (such as policy choices, technology, and prices) can affect the performance of the system and the “need” for capacity, making any interpretation of the term “need” itself relative and shifting. The focus should be on maximizing *valuable* investments. For example, how

33 National Surface Transportation Infrastructure Financing Commission. “Paying Our Way- A New Framework for Transportation Finance.” Feb. 2009. See chapter two for a detailed analysis, including various scenarios of “the widening investment gap”.

Figure 2: Transportation Funding by Level of Government and Mode



many dollars could the government invest in transportation where the returns to society would be greater than five dollars for every one invested? What about fifteen to one? Transportation investment has not traditionally been thought of in this way, but an approach that seeks to maximize returns is appropriate for allocating scarce resources. The appropriate level of overall investment is obviously important; what the federal government's share of that investment should be is, of course, a separate but also important question.

Surprisingly, as Figure 2 shows, federal outlays funded by fuel taxes account for only about 20 percent of national public spending on transportation.³⁴ States and localities are still the primary funders of transportation infrastructure, although states in particular orient a large part of their efforts to the task of getting money from the federal government.

The financing mechanisms in place to support the nation's highway and transit programs are unsustainable and in need of significant reform. The problem is not just that the current fuel tax and other taxes that support the highway and transit trust funds have not been increased or pegged to inflation, and that this is causing a growing funding shortfall. Rather, the central flaw of existing financing mechanisms is that they provide a poor signal to users about the costs they impose on the system. In other words, *how* we raise money for transportation is itself an extremely important policy decision—quite apart from the decision about how much money needs to be raised or where that money should go. Thus, reform of current financing mechanisms must be central to any effort aimed at making overall U.S.

transportation policy more performance-based, effective, and efficient.

The immediate funding issue is the inadequate level of the fuel tax, which has been shrinking dramatically in real terms even as the costs of managing and maintain-

Many factors can affect the performance of the system and the “need” for capacity, making any interpretation of the term “need” itself relative and shifting. The focus should be on maximizing valuable investments.

ing transportation infrastructure have soared. Indeed, the most conservative estimates of near-term system “needs” still far exceed the revenues this tax is projected to generate in coming years. Even if federal programs are more focused and consolidated there will still be a structural long-term problem with funding and underinvestment because there is not enough revenue to maintain the existing system, much less make needed improvements. Part of the problem is that the tax base itself—in other words, gasoline and diesel consumption—has been contracting. In fact, fuel tax revenues were declining even before the current economic downturn due to improving vehicle fuel economy and the introduction of alternative fuel vehicles, trends that were prompted in part by high oil prices earlier this decade.

The current fuel tax is also inadequate in the sense that it does not charge users anything close to the full costs associated with their activities on the transportation

34 Sunshine, Robert. “Public Spending on Surface Transportation Infrastructure.” Statement before the Committee on the Budget, House of Representatives. Congressional Budget Office, Washington, DC. 2007. http://www.cbo.gov/ftpdocs/87xx/doc8709/10-25-TranspInfra_Testimony.pdf. The Policy Commission reported the same numbers on p. 5-2 for highways and 5-8 for transit. Note that the Policy Commission also indicates that federal spending accounts for about 40% of all surface transportation capital outlays on page 41.

system. That is, it does not accurately reflect the full environmental, health damage, energy security, and congestion costs of individual transportation choices. If such costs were accurately priced they would affect users' decisions about a range of relevant issues, from where to live, when to commute, and what type of vehicle to drive. The failure to send accurate price signals in turn leads to inefficient levels of consumption—if prices are too low, the result will be excess demand.³⁵ For example, tax levels that fail to approximate the relative damage and cost imposed by heavy commercial vehicles will contribute to deteriorating road conditions by prompting more truck travel. Notably, a pilot mileage-based pricing program in Oregon demonstrated that, as drivers became more aware of the true costs of using the roads, they reduced their travel even when they incurred no additional costs for driving.³⁶

³⁵ Sorenson, Paul, et al. "Moving Los Angeles – Short Term Options for Improving Transportation." RAND Corporation. 2008.

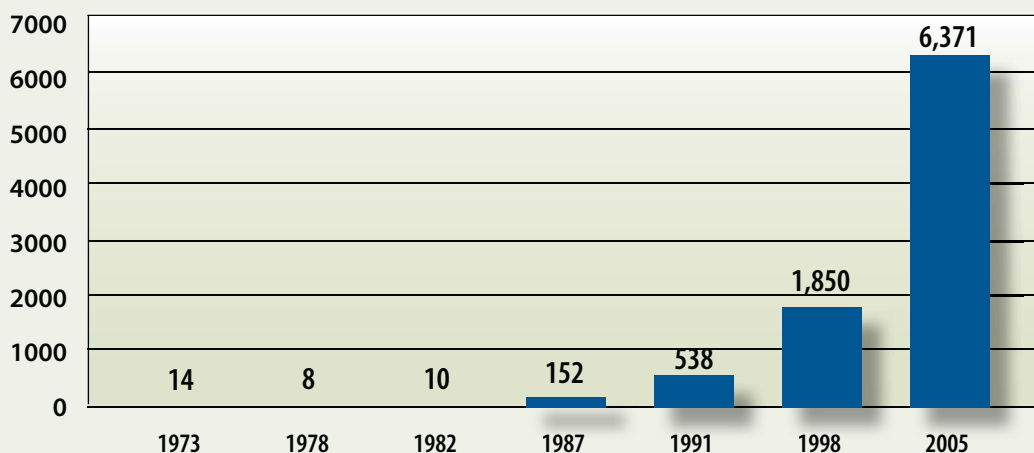
³⁶ Oregon Department of Transportation. "Oregon's Mileage Fee Concept and Road User Fee Pilot Program Final Report." 2007.

Finally, another problem with current funding mechanisms is that they impede the distribution of funds on a mode-neutral basis because most of the revenue is generated from road vehicles via fuel taxes and other fees. This is a problem for metropolitan programs because, despite some funding flexibility, projects are forced into either "highway" or "transit" categories—even though highway and transit systems work best in concert. This is an even more severe constraint for freight projects, which are unlikely to be funded absent an unbiased assessment that considers all mode choices and absent the ability to partner across modes. In short, adopting a mode-neutral approach to new investments may be extremely difficult in practice when all of the funding is coming from users of one mode.

CURRENT SPENDING PRACTICES: EARMARKS AND THE EQUITY BONUS PROGRAM

As discussed at length in the foregoing chapter, the central shortcomings of current federal transportation policy are failure to articulate clearly defined goals,

Figure 3: High-Priority Projects in Transportation Reauthorization Bills, 1973-Present



target resources in a way that maximizes overall system performance, and hold funding recipients accountable for results. One symptom of this lack of focus, as we have already noted, has been the proliferation of modally distinct programs, each with its own advertised purpose. Another is earmarking.

Controversy over Congressional earmarks reached a new intensity in recent years, due in part to the widespread media attention attracted by the now infamous “Bridge to Nowhere.” This bridge, proposed with the intent of connecting the small town of Ketchikan Alaska to an airport on nearby Gravina Island, struck a chord with the public as an example of government waste. With a price tag of \$223 million and only 7,000 Ketchikan residents as likely beneficiaries, the money for the bridge was eventually diverted to other projects. But it continued to feature prominently as a campaign issue in the mid-term elections of 2006 and again in the presidential election of 2008.

Although the popular press rarely connects the issue of earmarking to a deeper flaw in national transportation policy, the link is undeniable. The number of Congressional earmarks has increased dramatically with each new surface transportation bill since ISTEA (see Figure 3). For example, ISTEA listed 538 “high-priority projects”—under SAFETEA-LU that number increased to 6,371 projects. In dollar terms, the funds authorized for these priority projects increased from \$5.2 billion to \$13.5 billion.³⁷

And yet high-priority projects are only the tip of the iceberg. Some of the real growth in Congressional earmarking has occurred over and above discretionary programs that were designed to allocate money to

worthy projects on the basis of certain criteria. In theory, prospective grantees apply to these programs and the funding is then awarded at the discretion of the U.S. DOT. In practice, however, these programs have become earmarked so that there is no objective system for distributing funds based on merit.

For example, in SAFETEA-LU Congress created a new discretionary program called Projects of National and

Although the popular press rarely connects the issue of earmarking to a deeper flaw in national transportation policy, the link is undeniable.

Regional Significance (PNRS). The purpose of this program was to provide capital funding for “critical high-cost transportation infrastructure facilities” that were of major national or regional significance. Despite the fact that Congress authorized approximately \$1.8 billion over five years for this program, no grants were ever awarded through the discretionary process. Instead, all of the funding that was supposed to be available on a competitive basis was diverted to specific projects—based on a table that was entered directly into the legislation itself—before the competition could even begin. Though it was still relatively new in TEA-21, this type of earmarking expanded dramatically in SAFETEA-LU.

Political considerations rather than objective analysis also drive other areas of federal transportation policy, including policies with respect to passenger rail. If federal funding for Amtrak were subjected to cost-effectiveness analysis, it would likely be directed to a limited number of highly utilized corridors connecting cities separated

³⁷ Evans, Diana. “Greasing the Wheels: Using Pork Barrel Projects to Build Majority Coalitions in Congress.” New York: Cambridge University Press, 2004. Data for 2005 added.

by distances under 500 miles.³⁸ Instead, Amtrak operates a number of highly subsidized, long-distance routes that essentially amount to earmarks to maintain political support for what would otherwise be recognized as a costly and underutilized program.

In sum, while it may not be possible, or necessarily even desirable, to eliminate earmarks completely, a clearer articulation of the goals of federal transportation policy and a more transparently systematic application of those goals to funding decisions could significantly reduce the influence of earmarks and help build public support for programs that demonstrably improve transportation-system performance.

Money distributed via a formula does not necessarily have to be so disconnected from performance objectives

Although earmarks get all the bad press, they account for a much smaller share of federal transportation spending than the Equity Bonus Program: In SAFETEA-LU, for example, identified high-priority projects accounted for about 6 percent of the funding total, while the Equity Bonus program accounted for 16 percent.³⁹ The intent of the Equity Bonus Program is to balance geographic “equity” by returning to each state a minimum portion of its estimated contribution, via fuel taxes, to the Highway Trust Fund. The so-called Minimum Guarantee provisions in ISTEA and TEA-21 served the same function, but the program was overhauled

38 Government Accountability Office. “Intercity Passenger Rail, National Policy and Strategies Needed to Maximize Public Benefits from Federal Expenditures.” Nov. 2006. GAO-07-15. <http://www.gao.gov/new.items/d0715.pdf>

39 Fischer, John W. “Safe, Accountable, Flexible, Efficient Transportation Equity Act – A Legacy for Users (SAFETEA-LU or SAFETEA): Selected Major Provisions.” Congressional Research Service, Washington, DC. 2005.



and renamed for SAFETEA-LU. Thus, one of the biggest changes introduced under SAFETEA-LU involved reorganizing a purely political program with no defined policy purpose.

The Equity Bonus program is designed to address a concern that all states send their fuel taxes to the Highway Trust Fund, but some states get back more than they contribute while others receive less. This was perhaps less problematic when federal efforts were primarily focused on constructing the Interstate Highway System. States couldn’t easily object to other states receiving a greater share of collected fuel taxes if those states had more lane-miles of interstate highway to construct. As federal gas tax revenues were increasingly used to support other transportation projects and objectives (including some projects only tangentially related to transportation), however, equity emerged as a more volatile issue. Like its predecessor Minimum Guarantee program, the Equity Bonus program uses complicated formulas to add to the total amount of money each state receives from the federal transportation program. The program is designed to ensure that by the end of 2009 each state receives back at least 92 percent of the gas tax revenues it contributes to the Trust Fund.

From a performance and accountability standpoint, the Equity Bonus program is highly flawed. Essentially, the money it provides to states is free of restrictions—states can choose to spend it on almost anything they choose. Money distributed via a formula does not necessarily have to be so disconnected from performance objec-

tives—it is feasible for formulas to incorporate factors that reflect national interests and to build in measures that enable accountability. We propose to do exactly that.

GOALS AND PRIORITIES IN THE CURRENT PROGRAM

National interests in economic growth, national connectivity, the vitality of our metropolitan centers, environmental concerns and safety are all reflected in various aspects of existing transportation policies and programs. However, rarely do any current programs or policies provide direct links between funding and the achievement of these outcomes. To focus on how these significant national priorities are addressed, we focus in turn on current policies in the areas we have identified as goals:

- Economic growth - specifically national connectivity and metropolitan transportation
- Environmental concerns
- Safety

Current Policies and Economic Growth

Current policies do little to target federal support for transportation to the furtherance of economic growth. Although current policy often discusses the link to jobs and productivity, this link is largely rhetorical. This is evidenced, in part, by the weak connection between current transportation programs and more explicit economic outcomes including both national connectivity and improving metropolitan transportation.⁴⁰

National Connectivity

A systematic national focus on freight transportation, with a direct link to national productivity and growth,

has to a large degree “fallen through the cracks” of federally supported transportation planning.⁴¹ With limited attention and even less funding prioritization at both state and metropolitan levels, the performance of freight logistics has been steadily deteriorating.⁴²

The need for renewed and refocused federal involvement is particularly urgent in the case of freight transport systems, where current capital investment has not

Current policies do little to target federal support for transportation to the furtherance of economic growth.

been sufficient to maintain, let alone improve, performance.⁴³ The productivity of freight transportation in the United States has been dropping since 2003, for the first time in 25 years, driving up logistics costs for businesses and industries.⁴⁴ In fact, the direct costs of resulting freight transport delays are currently estimated to total more than \$8 billion annually.⁴⁵

41 I-95 Corridor Coalition. “A 2040 Vision for the I-95 Coalition Region – Supporting Economic Growth in a Carbon-Constrained Environment.” 2008.

42 1) Transportation Research Board. “Freight Capacity for the 21st Century, TRB Special Report 271.” 2002. <http://onlinepubs.trb.org/Onlinepubs/sr/sr271.pdf>. 2) “Policy Options for Intermodal Freight Transportation, TRB Special Report 252.” <http://onlinepubs.trb.org/Onlinepubs/sr/sr252.pdf>

43 Government Accountability Office. “Freight Transportation: National Policy and Strategies Can Help Improve Freight Mobility.” Jan. 2008. GAO-08-287.

44 Logistic costs rose through the 1960s and 1970s, reaching a high of about 16 percent of GDP in 1980. Renewed public investments in highways, economic deregulation of the rail and trucking industries, adoption of new technologies (principally, the growing use of containers for moving freight both internationally and domestically), and lower interest rates drove down the costs of truck, rail, air, and water freight transportation during the 1980s and 1990s, with the result that logistic costs reached a low of about 8.6 percent of GDP in 2003. Logistics costs grew after that, reaching 9.9 percent of GDP in 2006.

45 Cambridge Systematics, using data from the Federal Highway Administration’s Highway Economic Requirements System model.

40 Congressional Budget Office. “Issues and Options in Infrastructure Investment.” May 2008. <http://www.epi.org/publications/entry/pm132/> and <http://cbo.gov/doc.cfm?index=5624>.

While the nation's current economic crisis will no doubt interrupt for a time the growth trends that have characterized freight and goods movements in the United States in recent years, the demand for freight transportation has been pressing against the capacity of the system for some time. And even taking into account the present downturn, the most recent long-term forecasts by the Congressional Budget Office (CBO) still project that the U.S. economy will grow at a compound annual rate of 2.4 percent over the next 30 years.⁴⁶ As a result, the demand for freight transportation is still projected to nearly double between 2005 and 2035, with twelve states projected to experience more than a 200 percent

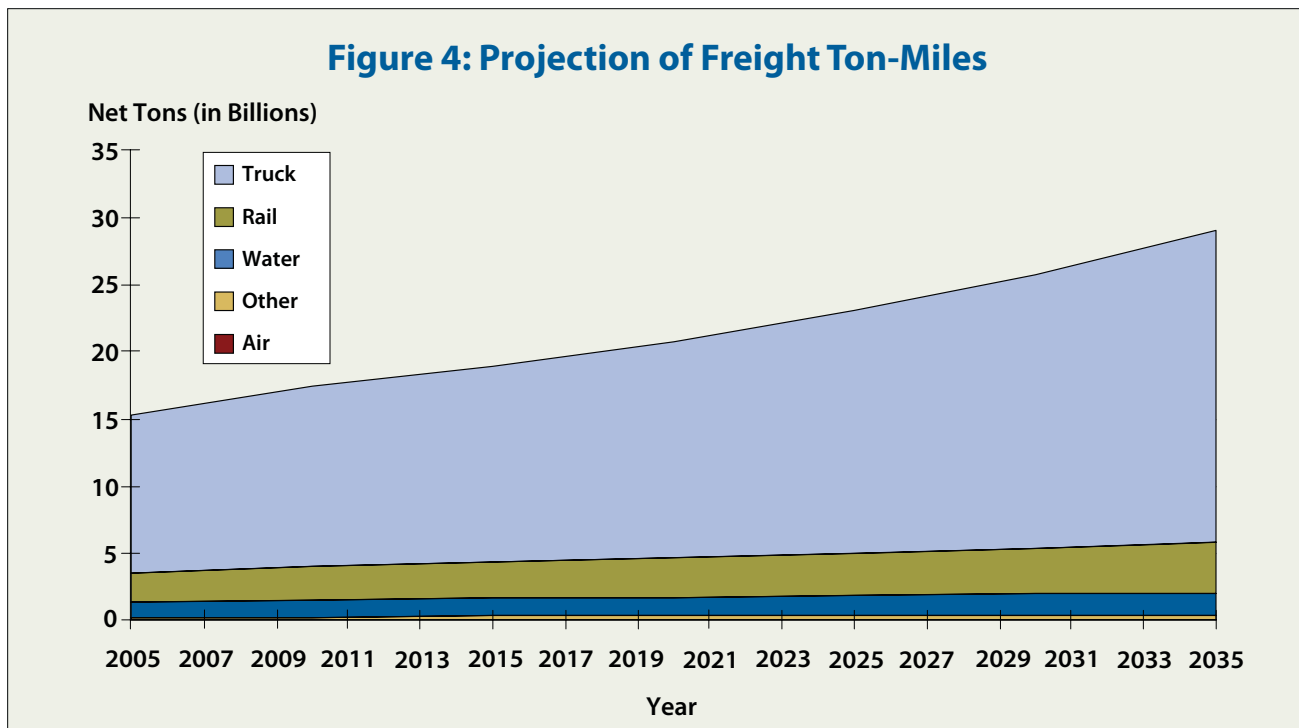
46 Recent forecasts by the CBO and the U.S. Department of Energy's Energy Information Administration (EIA) lower the projected average annual GDP growth rate over the next 30 years from 2.8 to 2.4 percent, reflecting the impact of the current recession, increasing energy costs, and the potential cost impacts of greenhouse gas emission regulations. The implications of the lower growth rate are discussed later in this section.

increase in freight flows.⁴⁷ Measured in tons, freight demand is projected to grow from 15 billion tons in 2005 to 29 billion tons in 2035—almost doubling. Measured in ton-miles, freight demand is projected grow from 6 trillion ton-miles today to 11 trillion ton-miles in 2035—also almost doubling. Trucks, which today carry almost 80 percent of freight tonnage, are likely to remain the dominant form of freight transport if current trends continue. In fact, their share of total freight transport is actually projected to grow slightly.

The current congestion in the national freight system is undermining the reliability and connectivity of goods movements, which are essential to the nation's economic well-being. The Interstate Highway System and the nation's transcontinental railroads link producers and consumers across the United States, providing the ac-

47 Global Insight, Inc., 2004 TRANSEARCH data and economic forecasts.

Figure 4: Projection of Freight Ton-Miles



cess to the resources, labor and markets that is essential to economic activity and development.⁴⁸

But the connectivity of the nation's highway and rail systems—the ability to move freight quickly, cost effectively, and reliably from region to regions and across the country—has not kept pace with population and

Congestion in the national freight system is undermining the reliability and connectivity of goods movements, which are essential to the nation's economic well-being.

economic growth. Large areas of the country are underserved by the highway and rail freight transportation system, which is hampered by congestion, deteriorating infrastructure, and missing links. Current capital investment in the freight transportation system is not sufficient to maintain, let alone improve, its performance.

The National Transportation Policy Commission and others⁴⁹ have sought to underscore the urgency of the freight transport challenge, noting not only that America's economic leadership in the world will be jeopardized if we cannot reliably and efficiently move our goods, but that the nation's ability to create wealth will depend in great part on the success of its freight ef-

iciency.⁵⁰ The UK Eddington Report likewise concluded that it was essential to focus on critical corridors and on those strategic freight networks that offered the highest returns on national investments.⁵¹ While the FHWA has begun defining critical freight corridors, however, there remains little identifiable focus in the way in which federal funds are allocated for needed improvements in critical freight bottlenecks. Moreover, though some efforts have been made to create new programs targeted to freight issues, congressional designation or earmarking has been the norm for these programs. For example, a U.S. DOT review and evaluation of the freight-focused border and corridor programs observed that almost 40 percent of total allocations in fiscal years 1999 to 2003 were concentrated on five states: West Virginia, Kentucky, Texas, California, and Washington, with limited correlation to any objectively determined national priorities.

In addition to a national interest in the efficient movement of goods, there is a national interest in the efficient interstate movement of people.⁵² Existing programs remain mode-specific rather than performance based, focusing on highways, rail, and support of special needs populations or high cost and isolated communities rather than on broader social objectives, including the

48 American Road and Transportation Builders Association. "A New Vision & Mission for America's Federal Surface Transportation Program." Nov. 2007. <http://www.artba.org/mediafiles/currentissuessafetea-lurecommendationspdf.pdf>

49 Note specific recommendations from several Transportation Research Board reports: Transportation Research Board. "Special Report 252: Policy Options for Intermodal Freight Transportation." 1998. Washington, D.C.; Transportation Research Board. "Special Report 271: Freight Capacity for the 21st Century." 2003. Washington, D.C.; and Federal Highway Administration. "Addressing Freight in the Transportation Planning Process." Oct. 2001. Washington, D.C..

50 National Surface Transportation Policy Study and Revenue Commission. "Transportation for Tomorrow." 2007.

51 United Kingdom Department for Transport. "The Eddington Transport Study: The Case for Action." 2006. Eddington emphasized that the major challenge is to improve the network in strategic areas, not to build new infrastructure. The report indicates that from an economic growth and productivity perspective, there is a clear need to prioritize the parts of the system where there are clear signals that part of the network is not performing. There is no strategic reason for action in all places. Growing and congested areas, and their catchments, are likely targets, as are key inter-urban corridors and key international gateways. These areas are critical for economic growth, are already experiencing significant congestion, and are estimated to experience more.

52 Reconnecting America, a national group focusing on this issue, has been promoting national policies for intercity travel with the intent of creating a more financially stable interconnected network for long distance travel, providing convenient connections to air, higher speed rail or high quality bus service to complete their journeys.

improvement of accessibility, integration, and social inclusion.⁵³

While private automobiles account for the vast majority of intercity passenger movements, intercity bus and passenger rail can be time- and cost-competitive with other modes of transportation—and thus hold real potential for improving national connectivity while reducing energy and environmental externalities. There has, however, been little or no federal role in integrating highway investments with potential intercity bus improvements. The result is an intercity bus network that is rarely competitive with the automobile.

Despite the critical importance of major metropolitan regions to the national economy, environmental quality, and energy security, national transportation policies and programs have not been particularly designed to strengthen these areas.

In terms of intercity passenger rail, the current Amtrak system—as noted in the previous chapter—is in poor financial condition, characterized by continued high operating losses and substantial levels of deferred capital and maintenance projects. It is clear that the comparative advantages of passenger rail are concentrated in high-density, high-travel corridors, including routes such as Chicago-Minneapolis, San Diego-Los Angeles, Seattle-Portland, or Washington-Boston.

53 These broader societal objectives are noted as contributing to the rationale for a federal role in supporting passenger movement in a 1996 UK policy statement. The policy went on to note that transportation system improvements that successfully deliver benefits of this type may be justified, even if they do not produce a positive effect on economic performance.

A comprehensive GAO review of passenger rail potential, which took into account successes and strategies in other countries, concluded that the current structure for supporting intercity passenger rail does not effectively target federal funds where they may achieve the greatest level of public benefits. The current Amtrak route map, in particular, is not focused on the markets where rail may have a comparative advantage over other modes and is most likely to be a viable and cost-effective option to meet public transportation demands.⁵⁴ The GAO review concluded that without any changes to its current structure, roles, and funding, “the current intercity passenger rail structure will continue to under-serve, under-invest, and underachieve.”⁵⁵

Metropolitan Transportation

Given the importance of metropolitan areas to the nation’s overall economic competitiveness and long-term prosperity, a clear national policy for meeting their changing transportation needs is essential. Federal spending patterns still reflect the priorities of an earlier era when the focus on connecting far-flung parts of the country via the interstate highway system led to high levels of per capita spending in areas with relatively low population density.⁵⁶ A half century ago, federal policy was focused on the process of “decentralization” as large industrial cities gradually lost population.⁵⁷ What eventually emerged, however, was a nation in which suburbs

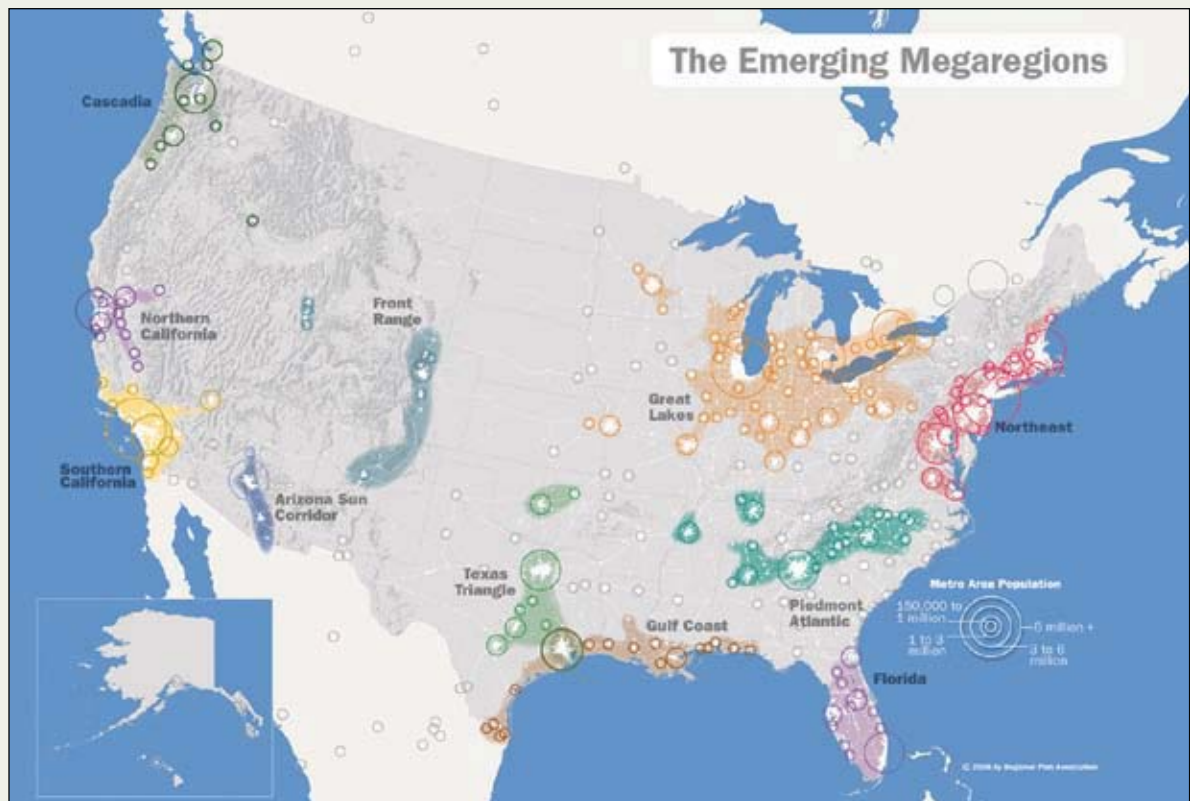
54 Government Accountability Office. “Intercity Passenger Rail, National Policy and Strategies Needed to Maximize Public Benefits from Federal Expenditures.” Nov. 2006. GAO-07-15. <http://www.gao.gov/new.items/d0715.pdf>

55 See also, 1) Congressional Budget Office. “The Past and Future of U.S. Passenger Rail Service.” 2003. <http://cbo.gov/doc.cfm?index=4571>
2) Government Accountability Office. “High Speed Passenger Rail: Future Development Will Depend on Addressing Financial and Other Challenges and Establishing a Clear Federal Role.” Apr. 2009. GAO-09-560T.

56 Altshuler, Alan with James Womack and John R. Pucher. “The Urban Transportation System: Politics and Policy Innovation.” 1979.

57 Jackson, Kenneth. “Crabgrass Frontier: The Suburbanization of the United States.” 1985. New York: Oxford Press, p. 190.

Figure 5: U.S. Metropolitan Areas and Mega-Regions^{58 59}



58 Glaeser, Edward L. and Joshua D. Gottlieb. "The Economics of Place-Making Policies." *Brookings Papers on Economic Activity*, forthcoming.

59 Graphic courtesy of the New York Regional Plan Association.

and cities became parts of larger economic units that differed from traditional urban centers in that they spanned broad areas and often crossed state lines.

The next 50 years will see the U.S. population increase by another 150 million people. Much of this growth will be concentrated in the nation's major metropolitan areas, which are increasingly functioning as the centers of economic mega-regions (see Figure 5). These mega-regions and the clusters of cities within

them constitute national and global trade blocs, competing and cooperating with one another for resources, knowledge, population, and investment.⁶⁰

60 Megaregions are defined as clusters of more than two contiguous metropolitan areas that have functional relationships through shared activity and geographic patterns and which form a functional network via goods and service flows within linked infrastructure. This phenomenon was first recognized in the 1960s focusing on the Northeast Megalopolis alone. These megaregions compete directly with about 40 such megaregions around the world.

These agglomerations of economic activity have steadily swelled in population and importance in recent decades but transportation spending has continued to focus on areas with lower densities.¹ As a result, the most economically productive and populated areas of the country tend, if anything, to receive a relatively smaller share of federal transportation dollars compared to other areas.⁶¹

Despite the critical importance of major metropolitan regions to the national economy, environmental quality, and energy security, national transportation policies and programs have not been particularly designed to strengthen these areas. This is understandable because metropolitan regions are economic, rather than political units. Federal transportation programs that have been disproportionately directed to urban areas (such as most transit programs) are directed to specific projects and are fragmented by modal and jurisdictional lines. Rarely do federal transportation programs look to the performance or to the results of integrated multi-modal metropolitan transportation networks.

The most salient indicator of an under-performing transport system in many large metropolitan areas is chronic traffic congestion. Congestion delays are a daily frustration for millions of Americans, the vast majority of whom (approximately 90 percent) commute to work by car.⁶² One study estimated that congestion delays in metropolitan areas add up to more than 4 billion person hours of lost time each year and cost the economy approximately \$78 billion.⁶³ Many Americans have no choice but to endure congestion because 45 percent have no available public transportation service options

61 Analysis based on Bureau of Transportation Statistics and American Community Survey. A major exception is spending on public transportation much of which does go to major metropolitan areas.

62 Transportation Research Board. "Community in America III: The third national Report on Commuting Patterns and Trends." 2006.

63 Texas Transportation Institute. "Urban Mobility Report." 2007.

at all, and more still have poor ones.⁶⁴ In addition to taking a toll on economic productivity and quality of life, congestion impedes the movement of goods in urban areas and drives up costs; it also causes excess fuel consumption and pollution emissions.

Despite the urgent need – and economic justification – for federal support for effective strategies to address these problems, the vast majority of federal formula programs neither require nor facilitate states or metropolitan regions using federal dollars to develop comprehensive effective strategies. A limited exception is the relatively small but performance related program – the Urban Partnership Program – discussed at the close of this chapter.

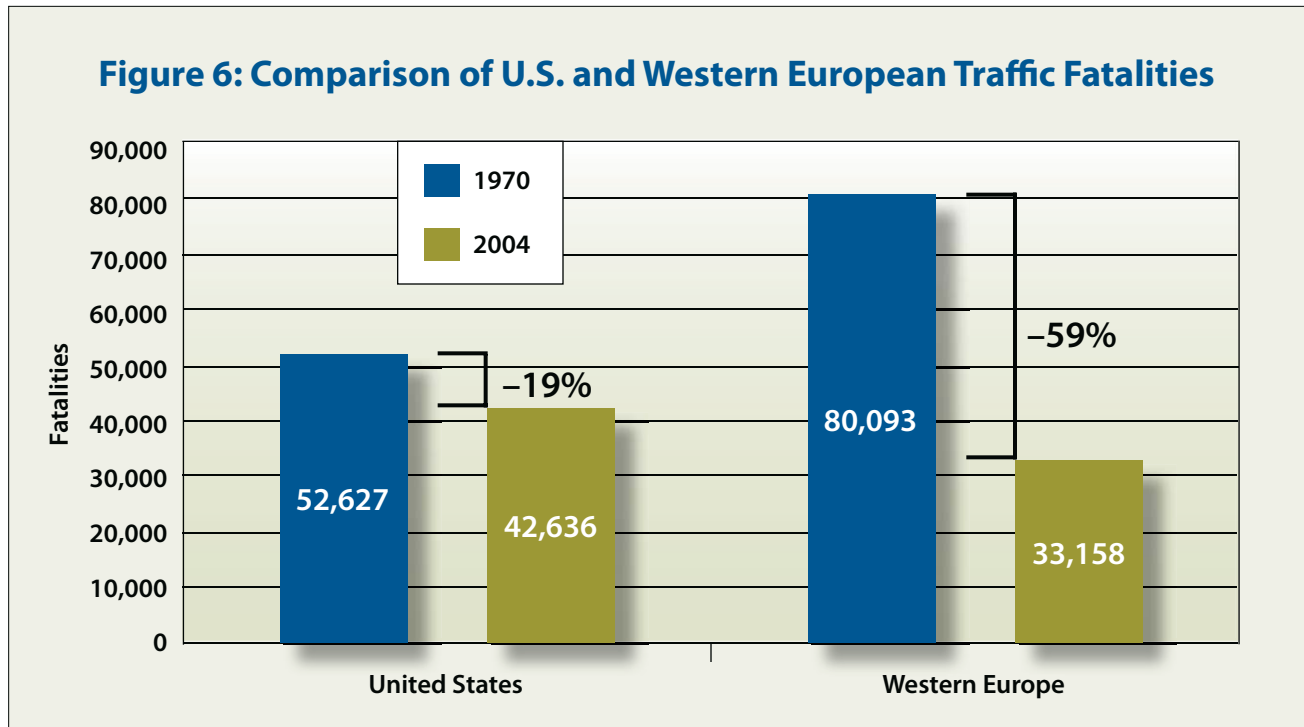
The EIS occurs at the project level, while energy and climate impacts are most clearly seen through a larger aperture, at a programmatic level.

Current Policy on Environmental Protection

As noted in the previous chapter, efforts to address environmental concerns in the transportation policy context are generally limited to considering the direct local impacts of a particular project—national, or global-level environmental issues such as climate change are not typically taken into account in any systematic way.⁶⁵ For example, the environmental impact statement (EIS) required during the planning and construction phase of a new project is designed to identify the environmental

64 Brookings Metropolitan Policy Program. "A Bridge to Somewhere: Rethinking American Transportation for the 21st Century." 2008.

65 1) World Business Council for Sustainable Development. "Mobility 2030: Meeting the Challenges to Sustainability." July 2004. 2) Transportation research Board. "Toward a Sustainable Future- Addressing the Long Term Effects of Motor Vehicle Transportation on Climate and Ecology, Special Report 251." 1997. 3) Sperling, Dan and Deborah Gordon. "Two Billion Cars-Driving Toward Sustainability." 2009.



effects of a project as well as possible alternatives. If the project is forecast to increase traffic, then the particulate pollution from that increase is calculated. If the roadway will create more noise in surrounding communities, then a sound wall is constructed to mitigate the problem. These project-level responses are not necessarily faulty in terms of addressing local impacts, but they are inadequate for the broader challenges we face. The EIS occurs at the project level, while energy and climate impacts are most clearly seen through a larger aperture, at a programmatic level.

The second significant policy mechanism currently being used to address transportation-related environmental concerns involves the conformity rules required by the Clean Air Act Amendments (CAAA) of 1990. The CAAA, which set new deadlines for areas to attain national air quality standards, established a new man-

date: Before a transportation project can receive federal funding, sponsors must demonstrate—on the basis of an emissions analysis—that it will “conform” to the state’s pollution reduction goals.⁶⁶ A further effort to integrate air quality objectives with transportation policy eventually took the form of the Congestion Mitigation and Air Quality Improvement (CMAQ) program, which was established a year later as part of the ISTEA bill. CMAQ funds generally go toward supporting transportation control measures identified in the CAAA. These measures are intended to cut vehicle pollution by reducing travel demand and encouraging more efficient facility use.⁶⁷

66 Environmental Protection Agency. “The Plain English Guide to the Clean Air Act.” <http://www.epa.gov/air/peg/carstrucks.html>

67 Transportation Research Board. “Special Report 264: The Congestion Mitigation and Air Quality Improvement Program, Assessing 10 Years of Experience.” 2002. <http://onlinepubs.trb.org/Onlinepubs/sr/sr264.pdf>

While the local flexibility allowed by the CAAA in meeting pollution goals is appropriate, application of the law itself has been disappointing due to a dearth of good data. Lacking reliable data, the modeling work so integral to demonstrating and testing conformity becomes detached from reality, and loses most of its value. Along with the data problems that plague conformity determinations, the CMAQ program lacks a performance focus and accountability. As a 2002 study by the Transportation Research Board observed, “The CMAQ program was never structured to be evaluated in a rigorous way.” The study went on to note that “few evaluations have been conducted following the completion of CMAQ projects to determine whether modeled estimates have been realized.”⁶⁸ Perhaps the more basic issue is that the conformity process and CMAQ are still primarily focused at the project level, and are not well-suited for measuring meaningful performance with respect to national-level goals.

Mortality and injury rates—as well as accident-related economic losses—on the nation’s highways are far in excess of those found in most other developed countries.

Current Policy on Safety

The U.S. transportation system continues to fall short with respect to safety: Mortality and injury rates—as well as accident-related economic losses—on the nation’s highways are far in excess of those found in most other developed countries. In 2007, more than 41,000 people died and 2.5 million were injured⁶⁹ on U.S.

68 Transportation Research Board. “Special Report 264: The Congestion Mitigation and Air Quality Improvement Program, Assessing 10 Years of Experience.” 2002. <http://onlinepubs.trb.org/Onlinepubs/sr/sr264.pdf>

69 United States Department of Transportation Federal Highway Administration. “Traffic Safety Facts 2007 Data.” DOT HS 810 993. <http://safety.fhwa.dot.gov/facts/>

highways. Beyond the staggering human loss implied by these figures, highway accidents impose enormous economic costs in lost wages, medical bills, and delays. A 2002 presentation by American Association for State Highway and Transportation Officials (AASHTO) estimated the annual cost to society at more than \$230 billion;⁷⁰ a later (2008) estimate by the American Automobile Association (AAA) put the figure at \$164.2 billion annually, nearly two and a half times greater than the \$67.6 billion price tag for congestion travel time delays.⁷¹ Moreover, motor vehicle crashes are the leading cause of death and injury for all Americans between the ages of 3 and 33.

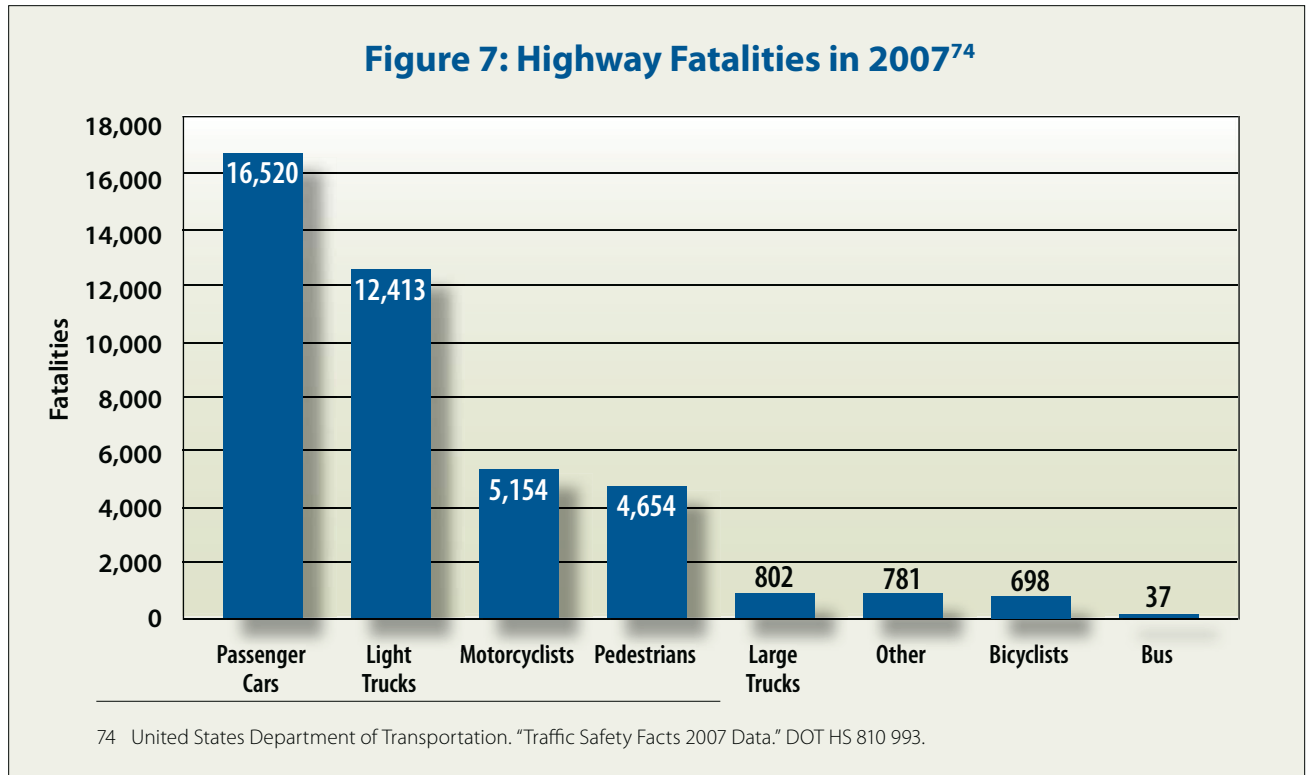
At present, the fatality rate on U.S. roadways stands at 1.37 deaths per 100 million vehicle miles of travel. This represents a significant improvement over the last four decades—in 1975, the fatality rate exceeded 3 deaths per 100 million vehicle miles—but it is still higher than the fatality rate in most other developed countries on a vehicle miles traveled basis.⁷² In comparison, for example, annual deaths in Western Europe, a region of similar size and population, currently total about 33,000—well below the U.S. figure;⁷³ moreover as shown in Figure 6, the percentage decline in traffic fatalities between 1970 and 2004 was much lower in the United States than in

70 American Association of State Highway and Transportation Officials. “Flash! You Were Caught Violating a Traffic Law.” Sep. 29, 2005 presentation, page 2. <http://cms.transportation.org/sites/aashto/docs/Kane-2005-09-29.pdf>.

71 American Automobile Association. “Crashes vs. Congestion, What’s the Cost to Society?” Mar. 2008. <http://www.aaanewsroom.net/Main/Default.asp?CategoryID=7&ArticleID=596>.

72 The United States has more fatalities per 100,000 inhabitants and more fatalities per vehicle mile traveled than the vast majority of Western European countries. Organisation for Economic Co-Operation and Development, Working Group on Achieving Ambitious Road Safety Targets. “Country Reports on Road Safety Performance.” Aug. 2006. <http://www.internationaltransportforum.org/jtrc/safety/targets/Performance/TS3-summary.pdf>

73 Organisation for Economic Co-Operation and Development, Working Group on Achieving Ambitious Road Safety Targets. “Country Reports on Road Safety Performance.” Aug. 2006. <http://www.internationaltransportforum.org/jtrc/safety/targets/Performance/TS3-summary.pdf>



Western Europe. Broadly speaking, safety gains over the years have resulted from a trio of actions: vehicle technology breakthroughs that have improved crashworthiness and safety features like airbags; policy interventions, such as drunk-driving penalties and seatbelt laws; and engineering and design improvements to road infrastructure.

Highway accidents account for the overwhelming majority of transportation fatalities in the United States—no other mode of travel, such as air or rail, has annual fatality rates that exceed 1,000 lives lost. Looking at the highway statistics in more detail, as Figure 7 illustrates, the majority of fatalities occur in cars or light trucks (less than 10,000 pounds gross vehicle weight). Note that

this chart is not an effective comparison of safety across modes. For example, motorcycles are more dangerous on a per-mile or per-hour basis than passenger cars, but many more people drive passenger cars. We have not provided a per-mile or per-hour comparison in this chart because there is no available mileage data for all modes.

In 2007, railroads had the second-worst fatality rate of any major transport mode, but the numbers still would have ranked only fifth (after pedestrians) in the breakdown of highway deaths shown in Figure 8.⁷⁵

⁷⁵ Bureau of Transportation Statistics. "Table 2-1: Transportation Fatalities by Mode." http://www.bts.gov/publications/national_transportation_statistics/html/table_02_01.html

Experience to Date with Performance-Based Programs

THE BRIDGE PROGRAM

An example of a transportation program that was designed to have a rudimentary performance focus is the federal Highway Bridge Program (HBP). HBP provides federal support for bridge construction and bridge maintenance that would otherwise be too costly for states to fund on their own.⁷⁶ It is performance-oriented insofar as the formula for allocating resources is based on needs and costs; in addition, the program includes a penalty for diverting funds away from bridge investments.

In some ways, HBP has been successful: The number of structurally deficient bridges has declined over the last ten years. On the other hand, a recent report reviewing the performance of the program indicated that the data and measures used to apportion federal funds are not necessarily good proxies for the safety or risk associated with specific bridges. Perhaps even more significantly, a closer look at the data shows that most of the improvement over the past 20 years has been in locally owned and rural bridges. The large bridges that are most critical for interstate commerce have costs that are too high to be covered by the HBP. The result is that states use their federal bridge funds for smaller bridge rehabilitation projects. When major bridges need replacement or rehabilitation, states for the most part seek earmarks or other funding sources. Since HBP funds are apportioned to states without regard to furthering *national* goals, states have no incentive to focus on the most nationally significant projects and are not held accountable for the results of their investments.⁷⁷

⁷⁶ American Association of State Highway and Transportation Officials. "Bridging the Gap." 2007.

⁷⁷ Government Accountability Office. "Highway Bridge Program: Clearer Goals and Performance Measures Needed for a More Focused and Sustainable Program", GAO-08-1043 p.40 September 10, 2008 GAO-08-1043. p. 40. <http://www.gao.gov/new.items/d081043.pdf>



While the collapse of the I-35 bridge in Minneapolis in 2007 is widely viewed as emblematic of a chronic problem of deferred maintenance and underinvestment in the nation's infrastructure, the recently released accident report and recommendations by the National Transportation Safety Board (NTSB)⁷⁸ indicate that inadequate federal support was not the issue in this particular instance. Instead, the NTSB concluded that the probable cause of the collapse was an error in the design⁷⁹ of the gusset plates.⁸⁰ Further, while NTSB accident reports often lead to recommendations for improved maintenance to reduce the risks of future accidents, the NTSB's recommendations in this case centered on bridge design and on the need to give closer attention to the conditions of gusset plates in load rating analyses. Specifically, NTBS recommended that FHWA develop and implement a bridge design quality assurance/

⁷⁸ National Transportation Safety Board. "Collapse of I-35W Highway Bridge, Minneapolis, Minnesota, August 1, 2007." Nov. 14, 2008. NTSB/HAR-08/03, PB2008-916203. <http://www.dot.state.mn.us/i35wbridge/ntsb/finalreport.pdf>

⁷⁹ Concern about this design error in fact led to an immediate nationwide review of all similarly constructed bridges and efforts to correct apparent previously poorly understood structural weaknesses.

⁸⁰ The report further notes that the plates "failed under a combination of (1) substantial increases in the weight of the bridge, which resulted from previous bridge modifications, and (2) the traffic and concentrated construction loads on the bridge on the day of the collapse.

quality control program for use by states and other bridge owners.⁸¹

In many ways, the popular misperception that bridges are falling down due to underinvestment underscores the challenge of implementing a performance- and evidence-based approach to transportation policy. When the underlying causes are misunderstood, the response to cataclysmic events often consists of simply throwing more funding into a flawed delivery mechanism, rather than pursuing comprehensive and cost-effective strategies for improving the performance and reliability of the overall system.

THE HIGHWAY SAFETY IMPROVEMENT PROGRAM

In SAFETEA-LU, Congress took considerable steps to tackle persistent highway safety risks through the Highway Safety Improvement Program (HSIP). The funds for state safety programs were nearly doubled, and a new provision was included seeking to make the program more performance-based. States are now required to complete comprehensive plans that provide a more empirical basis for state programs and priorities. Plans have to include a wide range of stakeholders, define areas of safety emphasis through an analysis of state fatality data, propose strategies to address the highest risks for all public roads, and provide for an evaluation of both plan implementation and actual progress in reducing crashes and fatalities. States are also required to advance public awareness by publicly reporting on at least 5 percent of the most accident-prone locations.

While all states have completed HSIP plans and launched programs that aim to combine engineer-

ing and behavioral approaches, a recent GAO review observed that restrictions on the use of funds and set-asides appear to conflict with a risk- and performance-based use of federal funds. In particular, while \$900 million in formula funds were apportioned to the fifty states based on equal risk-based factors, \$200 million was set aside for rail-highway crossings. It turns out that expenditures on grade crossings are rarely aligned with state-identified priorities; for example, some states

Broad support exists for an active and renewed federal role in addressing highway safety

have reported that the rail-highway crossing set-aside program provides significant funding to some crossing areas that have relatively few fatalities. Furthermore, restrictions were placed on the use of funds for prioritized behavioral or emergency medical service enhancements, and over \$300 million were distributed under the program solely to meet the “equity bonus” return to states with no linkage to either safety needs or performance outcomes. Finally, GAO also reported that states had serious difficulties in reliably identifying high-risk rural roadways and developing appropriate remedies due to severely limited data on rural roads and crashes. In short, despite being designed as a performance-based program, federal funding is restricted or mandated in ways that do not allow states to fund identified priorities in their strategic plans.⁸²

Broad support exists for an active and renewed federal role in addressing highway safety—in fact, both the Bush administration’s transportation reform proposal

81 The recommendation further noted that the quality assurance program “includes procedures to detect and correct bridge design errors before the design plans are made final; ... Modify the approved bridge inspector training as follows: To address inspection techniques and conditions specific to gusset plates and include revisions to the *Bridge Inspector’s Reference Manual*, to address any newly gusset plate condition ratings.”

82 Government Accountability Office. “Highway Safety Improvement Program, Further Efforts Needed to Address Data Limitations and Better Align Funding with States’ Top Priorities.” Nov. 2006. GAO-09-35. <http://www.gao.gov/new.items/d0935.pdf>

and the National Transportation Policy Commission called for increased efforts in this area. Specifically, the Bush administration reform proposal recommended a data and technology-driven approach to safety⁸³ and the U.S. DOT has supported research on current safety performance measures and strategies for improving them.⁸⁴ The National Transportation Policy Commission noted that the country lacks a national plan for safety to inform transportation planning and investment and called on the U.S. DOT to define safety performance metrics (e.g., fatalities and serious injuries per 100 million VMT) to be used by all federal, state, and local agencies to measure progress.⁸⁵

The program features a rigorous evaluation process and shared decision-making between the executive and legislative branches.

THE NEW STARTS PROGRAM

The New Starts program is essentially the only discretionary, metropolitan-focused transportation program of any size today (its appropriations have totaled between \$1.5 and \$2 billion per year since 2005). It funds fixed guide-way transit projects (rail, busways, etc.), including both new lines and extensions. The discretionary design of the program responds to the “lumpy” nature of investments in these kinds of projects: Transit agencies enter and exit the program over time as major capital investment projects advance to the point where sizable funding is required. Because of its competitive nature, the program features a rigorous evaluation process and

shared decision-making between the executive and legislative branches. Features of the New Starts program that are relevant for broader efforts to make transportation policy more performance-oriented include:

- **Shared decision-making:** With projects funded through annual appropriations, Congress has more oversight opportunities and a greater role in funding decisions.
- **Rigorous federal evaluation:** The rigor of the evaluation process and federal reviews has increased accountability and reduced federal risks.
- **Project-specific spending:** All New Starts grants are project-specific and the program experiences the least earmarking of any discretionary DOT program, primarily because Congress recognizes the rigor of the evaluation process and generally follows the funding recommendations of the Federal Transit Administration (FTA) after a commitment is made.
- **New money incentive:** As a discretionary program, New Starts brings new money to a metropolitan area. This creates an incentive for localities to pursue additional local, state, or private resources for a funding match, or overmatch, and to cover operations or maintenance costs.
- **Variable federal share:** By pressuring project sponsors to accept lower federal shares, FTA has more dollars to spread among more projects and metropolitan areas. This has the effect of broadening support and increasing the number of projects that receive needed assistance.

Despite these positive features, the New Starts program has been criticized for being excessively bureaucratic and costly and there is widespread concern that despite the relative rigor of the analyses required, projects with

83 United States Department of Transportation. “Refocus. Reform. Renew. A New Transportation Approach for America.” 2008. <http://www.atssa.com/galleries/default-file/RefocusReformRenew.pdf>

84 Traffic Safety Performance Measures for States and Federal Agencies, NHTSA Publication DOT HS 811 025, James Hedlund, August 2008

85 National Surface Transportation Policy Study and Revenue Commission. “Transportation for Tomorrow.” 2007. pp. 6-20.

Despite these positive features, the New Starts program has been criticized for being excessively bureaucratic and costly.

relatively few national benefits still get funded. Conversely, worthy projects may shy away from using the New Starts program, or may be substantially delayed and incur higher costs, due to the cumbersome nature of the program's funding processes. Some weaknesses of the New Starts program include:

- **Lack of performance incentives for project sponsors:** There has been limited formal accountability for the actual performance of New Starts projects, in part because actual performance is not known until years after a project is funded and construction is finished (the timeframe is even longer when compared to the time a project begins preliminary engineering).
- **No cost-benefit accountability.** The contract between recipients and the FTA is in the form of a Full Funding Grant Agreement (FFGA). As currently constructed, neither the FFGA nor the process associated with it requires a comparison of projected versus actual benefits (e.g., ridership).
- **Cost control:** As currently designed, the only control for cost risk is a cap on the federal investment in the Full Funding Grant Agreement (FFGA). This means that project sponsors are only responsible for cost overruns, and are not responsible for benefits that fall short of projections.
- **Intensive federal screening:** Because major project activities and decisions occur at the local level, the federal government must rely on applicants to provide the information that supports the federal investment decision and must spend considerable time reviewing information and data submitted by project sponsors to ensure that it is accurate, unbiased, and consistent with the evaluation methods required for a New Starts application. The process is so cumbersome and expensive that it discourages worthy applications.
- **Criteria are not comprehensive:** Although the criteria used to evaluate projects are generally respected by Congress, there have also been cases where DOT has ignored clear benefits in the cost-effectiveness measure because of the project-specific focus of the program. This has led to the beginning of a breakdown in the collaborative process between Congress and the Executive.
- **Lengthy project development process:** As requirements have grown and the reviews have become more rigorous, average project development times have increased from five years in 1991 to nearly ten years today. If projects are delayed unnecessarily, costs escalate and the federal return on investment decreases. More accountability on the back end could eliminate process requirements on the front end, thus expediting project deployment.
- **New money incentive:** In many transit projects there is a mismatch between the rate of return to the locality and the rate of return nationally—the latter being more relevant from the standpoint of evaluating the performance of a national program. This mismatch exists because New Starts funds represent “new money” that would not otherwise be available to a recipient. This can encourage project sponsors to pursue designs or project elements that may not be the most efficient over the useful life

of the investment. It also encourages a tendency toward compounding optimism in assumptions and analysis, which in turn necessitates more careful federal reviews to ensure that the information contained in funding applications is realistic.

- **Variable Federal Share:** FTA's negotiation of the New Starts share tends to be driven largely by funding availability and geographic equity considerations. This means that the amount of federal investment is not directly linked to project merit or to the federal government's return on investment.

THE URBAN PARTNERSHIP AGREEMENTS

Another possible model with some elements of a performance-based, competitive approach is the Urban Partnership Agreements (UPA). This program, which was created by the executive branch with unused appropriations, provided grants to cities to tackle congestion using a comprehensive approach but with an emphasis on variable pricing. The grants could be used for a variety of strategies that work in coordination, such as public transportation and technological upgrades.

The distinctive performance feature of this program was that it did not tie grants to a single type of project but rather provided recipients with financial resources, regulatory flexibility, and dedicated technical support in exchange for their adoption of aggressive congestion-reduction strategies. The program sought to overcome the modal bias of most past programs and to address the overall difficulty regions experience in planning and funding intermodal links and projects that involve more than one mode. It also illustrated the significant impact a comprehensive and performance-focused grant program could have in marshalling local political support for multi-modal strategies, policies, and investments.

Unfortunately, because the program lacked statutorily defined selection criteria it was strongly criticized by members of Congress as an earmarking program for the executive branch.⁸⁶ The program was also prescriptively focused on a single problem—congestion—and so did not provide a flexible mechanism for responding to local needs. This may be why some of the successful program applicants were unable to fulfill the terms of their grants and wound up not receiving any funds.

LESSONS LEARNED FROM CURRENT PERFORMANCE-BASED PROGRAMS

A competitive program targeting a difficult but shared goal can ignite fresh new coalitions and incentivize innovative, new approaches, including politically tough measures, to put forth effective strategies to successfully compete for scarce federal dollars. From the analyses above we can draw out several common essential features for the design of an effective performance-based program:

- **Actually linking funding to performance.** Simply defining program goals with eligibility standards does little to assure any desired performance outcome.
- **Getting the measures right.** This means clearly defining the desired outcomes in terms that can be reliably and consistently measured.
- **Shared decision-making.** An effective partnership between the legislative and the executive is necessary for assuring an outcome-oriented fact-based, objective and evidentiary decision making process.

⁸⁶ Government Accountability Office. "Urban Partnership Agreements: Congestion Relief Initiative Holds Promise; Some Improvements Needed in Selection Process." Mar. 2009. GAO-09-154.

Table 2: Lessons Learned From Select Program Examples

Program	Positive Attributes	Challenges
Highway Bridge Program	<ul style="list-style-type: none"> ■ Distribution of funds linked to performance ■ Public transparency of defined measures 	<ul style="list-style-type: none"> ■ Data/measures used to apportion funds not good indicator of safety or risk ■ Perverse incentive with poor condition increasing apportionment ■ Inability to direct funding towards national bridges affecting interstate commerce
Highway Safety Improvement Program	<ul style="list-style-type: none"> ■ Distribution of funds linked to performance ■ State plans now more comprehensive 	<ul style="list-style-type: none"> ■ Restrictions in use of funds prevent effective targeting of risk ■ Severe data limitations impede program focus and public reporting
New Starts Program	<ul style="list-style-type: none"> ■ Shared decision-making by executive and legislative branches based on detailed evidence and analysis ■ New money aids development of non federal revenue sources and coverage of continuing costs 	<ul style="list-style-type: none"> ■ No incentive to optimize system performance ■ Mismatch between local and national review of returns ■ Excessively detailed lengthy and costly process
Urban Partnership Agreements	<ul style="list-style-type: none"> ■ Incentivized comprehensive performance-focused plans ■ Promoted multi-modal strategies ■ Facilitated collaborative local planning 	<ul style="list-style-type: none"> ■ Lack of Congressional support for program ■ Criteria for allocation seen as imprecise ■ Prescriptive rather than bottom-up



A more effective, performance-oriented and results-driven approach to national transportation policy requires a clear articulation of national goals.





IV

IV. National Goals

A more effective, performance-oriented and results-driven approach to national transportation policy requires a clear articulation of national goals. From the outset, the NTPP identified and focused on five broad goals:

- Promoting economic growth
- Enhancing national connectivity
- Improving metropolitan accessibility
- Promoting environmental sustainability and energy security
- Improving safety

Each of these goals is intended to trigger a distinct and focused role for the federal government, and each goal is attainable only with substantial federal government participation. Many more specific purposes are outlined in the numerous federal transportation programs that already exist—these purposes are in no way precluded by the overarching goals we propose and, in fact, usually fit within them. National security, for example, underpins and is integral to all of these goals; a secure transportation system is a prerequisite to achieving any of them. Similarly, there are strong links between transportation planning and physical health.

Other nations have likewise undertaken a strategic reassessment of the role of the national government in re-

sponding to current and emerging transportation policy challenges. Because much can be learned from these efforts, NTPP—as part of its research for this study—

Each of these goals is intended to trigger a distinct and focused role for the federal government, and each goal is attainable only with substantial federal government participation.

examined the experience and conclusions reached by other countries similar enough to the United States to provide analytical value, specifically Canada, Sweden, and the United Kingdom.⁸⁷

The remainder of this chapter discusses the specific justification and role for federal involvement in transportation policy with respect to each of the above goals. Having established this foundation we proceed in subsequent chapters to outline performance metrics that can be used to measure progress toward each of our proposed national goals and to develop specific recommendations for re-organizing and reforming the current federal transportation program structure.

⁸⁷ No country can provide an exact parallel to the United States, but these three are sufficiently similar to be relevant to the discussion here.

Goal: Economic Growth

That economic growth is important and constitutes a legitimate national interest hardly requires further elaboration—the more interesting question for purposes of this discussion is how sound transportation policy relates to, and indeed advances, the goal of economic growth. Identifying economic growth as a goal for transportation policy also serves to underscore the point that transportation is a means to an end. Unlike most goods in society, transportation is rarely consumed without an additional purpose. Though some travel—whether on foot or by bicycle, car, train, or bus—is undertaken solely

Transportation is a means to an end.

for the purpose of enjoying the trip, such instances are relatively rare. The vast majority of travel occurs in order to get people or goods somewhere for the purpose of doing something else besides consuming transportation, and that something else generally contributes to the growth and productivity of the economy.

The connection between economic output and efficient transportation is most obvious in the case of work travel, which typically has the highest economic value of all passenger travel. Work travel is also the most expensive to provide for because infrastructure is built for peak capacity and the peak occurs during rush hour. Economically vital work-related travel—in many cases related to business meetings, air travel, and house calls—may also occur outside peak hours. A robust and high-performing transportation network that reduces work travel time contributes directly to workforce productivity and thus to the economic well-being of local communities and the nation as a whole.

Yet work travel comprises a smaller percentage of overall travel than it once did; today it accounts for a

smaller share of VMT in the United States than non-work travel.⁸⁸ But even non-work trips—whether to a dry cleaner, doctor’s office, restaurant, or baseball practice—have direct economic value. Enabling the fast, affordable and reliable completion of travel for these purposes is also essential to quality of life and economic well-being.

Finally there is freight travel, which has obvious and substantial economic value. An efficient, high-performing freight network is conducive to economic growth in many ways—it allows for broader sourcing of materials, improved competitiveness, lower costs for warehousing and logistics, and generally enhanced productivity. For many Americans, heavy trucks stuck in and contributing to road congestion are the most visible indicator of an inefficient freight transport system. But delay and inefficiency on freight networks has deeper economic consequences that may be less visible—contributing to higher prices for goods and reduced productivity, for example, and in severe situations actually acting as a drag on economic growth.

Many studies have sought to assess the role of transportation in generating economic benefits, including:

- The value of changes to travel times and travel reliability. If travel can be made faster or more reliable this allows increased production and consumption in a shorter period of time.
- The benefits of non-work travel. As discussed above, non-work travel can have substantial economic benefits, which include not only the consumption of goods and services, but also pleasure activities that have economic value.

88 Bureau of Transportation Statistics. “National Household Travel Survey 2001-2002.” http://www.bts.gov/programs/national_household_travel_survey/

Work travel comprises a smaller percentage of overall travel than it once did; today it accounts for a smaller share of VMT in the United States than non-work travel.

- Agglomeration⁸⁹ and labor market effects. Agglomeration stimulates innovation and productivity; in addition, larger labor markets provide greater economic resources. Both of these effects are increased by more efficient transportation, and they both impact economic productivity and global competitiveness.

However, the economic benefits of transportation investments can be challenging to quantify, particularly when those benefits relate to business productivity. This is especially true for transportation-related productivity improvements in the service and high-tech manufacturing sectors that dominate today's U.S. economy. But recent research has shed some light on how to capture these benefits:

- Professor Ishaq Nadiri of New York University completed the most notable empirical analysis to date to assess the relationship between highway investment and economic growth. Studying the effects of changes in highway assets from the 1950s through the mid 1990s, Professor Nadiri concluded that highway investment in the 1950s and 1960s provided an average 50–60 percent annual rate of return. More than half of the benefits to private industry were realized in services and nonmanufacturing sectors (in contrast to the more traditional view that freight, logistics and vehicle manufacturing benefit the most from highway improvements).⁹⁰

- The Eddington UK Transport Study notes that, on average, a 10 percent increase in transportation infrastructure investment increases gross domestic product (GDP) by approximately 2 percent. The report also states that up to 50 percent of all potential economic benefits of transportation investment go unreported.⁹¹
- A 2001 study by Remy Prud'homme and Chang-Woon Lee, titled "Size, Sprawl, Speed and the Efficiency of Cities," compared the productivity of European cities, particularly Paris and London. The researchers found that "The efficiency of a city is a function of the effective size of its labor market" and concluded that a 10 percent improvement in access to labor increases productivity, and therefore output, by 2.4 percent.⁹²

In sum, ours is a mobile society with an economy that depends on ready and reliable access to labor, raw materials, affordable and reliable energy, and the products of other firms. Transportation serves as "a key input" to production and economic activity along with other important inputs such as land, labor, and technology.⁹³ Thus, "Modern transportation facilities are necessary, but not sufficient," to ensure economic development.⁹⁴ Not surprisingly, similar conclusions have been reached by other countries; the UK Department of Transport,

89 Agglomeration refers to the dense co-location of people and jobs.

90 Nadiri, Ishaq and Theofanis Mamuneas. "Contribution of Highway Capital to Output and Productivity Growth in the US Economy and Industries." Federal Highway Administration. Aug. 1998.

91 United Kingdom Department for Transport. "The Eddington Transport Study: The Case for Action." 2006. Volume 3. <http://www.dft.gov.uk/about/strategy/transportstrategy/eddingtonstudy/>.

92 Remy Prud'homme and Chang-Woon Lee. "Size, Sprawl, Speed, and the Efficiency of Cities." Nov. 2001. <http://www.dublinpact.ie/word/Prud-homme-paper.doc>.

93 The National Chamber Foundation. "The Transportation Challenge – Moving the U.S. Economy." Apr. 2008. <http://www.uschamber.com/publications/reports/0804transportationchallenge>. Other key inputs or determinants of economic productivity include natural resources and tax rates. See also: Oregon Department of Transportation. "The Oregon Transportation Plan Update: Transportation and the Economy." http://www.oregon.gov/ODOT/TD/TP/docs/publications/otpBackground/otpBP_Economy.pdf.

94 Oregon Department of Transportation. "The Oregon Transportation Plan Update: Transportation and the Economy."

for example, identifies as one of its strategic objectives “to sustain economic growth and improved productivity through reliable and efficient transport networks.” Similarly, Transport Canada specifies three strategic objectives intended to help achieve its mission. The second of these is “An efficient transportation system that contributes to Canada’s economic growth and trade objectives.”

We turn next to national connectivity and metropolitan accessibility—two goals that are directly related to the national interest in economic growth.

Goal: National Connectivity

Connectivity—the ability to move people and goods quickly, cost-effectively, and reliably from region to region and across the country—is essential to America’s cohesiveness, security, and prosperity. This is also an area of longstanding federal involvement and obvious national interest. In the early 19th centuries, the call for “internal improvements” was central to national political debate. The federal government also offered concessions of public land for the construction of transcontinental railroads. In the 20th century, the federal government provided funds for road construction that would enable farmers to bring their goods to urban markets and railheads. Finally, after World War II, the construction of the Interstate Highway System and the establishment of a national system of airports and aviation facilities became federal priorities. As President Eisenhower put it in articulating the need for an interstate highway system: *“Our unity as a nation is sustained by free communication of thought and by easy transportation of people and goods....”*⁹⁵

95 National Surface Transportation Policy Study and Revenue Commission. “Transportation for Tomorrow.” 2007. Volume 1. http://www.transportationfortomorrow.org/final_report/vol_1_chapter_1.aspx.



Federal investment in national highway and rail systems has not kept pace, however, with population and economic growth. Large areas of the country are underserved and must cope with chronic congestion, deteriorating infrastructure, and missing links. Rapid growth in the Sunbelt region of the country, for example, is largely a post-interstate development and transportation investments have not kept up. Nationwide, there are 70 urbanized areas with populations of 50,000 or more that are not directly connected to the Interstate Highway System.⁹⁶ Meanwhile our intercity passenger rail and bus systems experience much lower patronage relative to similar industrialized nations.

Of course, national connectivity in the 21st century encompasses more than freight and passenger rail and the Interstate Highway System. Connections critical to the nation’s economy include those to key intermodal centers, seaports of entry, international border crossings, and airports. The growth of air travel, which plays a major role in inter-regional and leisure travel, and the introduction of broadband and other telecommunications infrastructure have changed the way we define connectivity. Whereas the term was traditionally understood as a measure of the directness of links and density of connections in the road network, the concept

96 Transportation Research Board’s National Cooperative Highway Research Program. “Future Options for the National System of Interstate and Defense Highways.” 2007.

of connectivity has evolved over time to encompass the demand for accessibility, including access to information. Simply “being connected” is not enough to remain competitive in the global market place: Today’s demands for global trade and information access require connections that are both “fast and direct” and more than just physical.⁹⁷ Access to broadband, in particular, must be considered when seeking to understand the potential relationship between information technology and surface transportation investments. Finally, connectivity in the current era must also include the idea of providing transportation options for those who cannot afford the level of mobility enjoyed by most Americans. This includes the idea of effectively linking small urban and rural areas to the transportation network, while also providing connections that are critical for national and global commerce.

A major challenge relevant to the goal of improving national connectivity remains the absence of mechanisms for collaboration across state lines, which in turn increases the need for federal leadership. The GAO has observed that the federal government lacks a defined role in, or mechanism for, aiding projects that span multiple jurisdictions. States, meanwhile, often find it difficult to coordinate large projects given their different priorities. For example, though it is widely agreed that the Tappan Zee Bridge in New York State should be replaced, neighboring Connecticut and New Jersey are directly affected by any bridge replacement but are not involved in the project. There is currently no established mechanism that allows all three states to work together to move the project forward.

The National Transportation Policy Commission was emphatic about the significance of the risk of continuing national inattention to this problem, noting not only that America’s economic leadership in the world will be

jeopardized if we cannot reliably and efficiently move our goods, but that the nation’s ability to create wealth will depend in great part on the success of its freight efficiency.⁹⁸ Though this warning is bold and clear, the complexity and nuance of the challenge in defining the roots of the problem is evidenced in minority views laid out by four dissenting members of the same Commission. These dissenters indicated that the most important challenge facing the connectivity of the national transportation system is a steady decline in transportation system performance and the increased politicization of transportation investment decisions.⁹⁹

There are some 51 metropolitan areas of this size around the nation; together they not only generate an estimated 70 percent of all wage income and 65 percent of GDP, but they particularly dominate the high-wage, high-growth sectors of the economy.

Goal: Metropolitan Accessibility

Metropolitan areas are so important to national economic growth that it is essential that they be recognized with a specific national transportation policy goal. As we noted in the previous section, much of the nation’s future growth, both in terms of economic activity and

97 United Kingdom Department for Transport. “The Eddington Transport Study: The Case for Action.” 2006. Volume 2.

98 National Surface Transportation Policy Study and Revenue Commission. “Transportation for Tomorrow.” 2007.

99 National Surface Transportation Policy Study and Revenue Commission. “Transportation for Tomorrow.” 2007. Minority Views, p.59. The dissenters concluded that it is a virtual economic certainty that congestion and system reliability will worsen if the nation continues to rely on a tax-based financing system that has little or nothing to do with the true costs of using or providing transportation infrastructure.

population, is expected to be concentrated in major metropolitan areas. Today, 84 percent of Americans live in a metropolitan area, which is defined as a county-based agglomeration that includes an urban area with at least 50,000 people. Some 163 million people, or 54 percent of the U.S. population, live in a metropolitan area that has a population above one million. There are some 51 metropolitan areas of this size around the nation; together they not only generate an estimated 70 percent of all wage income and 65 percent of GDP, but they particularly dominate the high-wage, high-growth sectors of the economy. Industries that require high human capital inputs are particularly likely to locate in metropolitan areas, in part because these areas offer dense labor markets, and patents are also clustered in metropolitan areas.¹⁰⁰ As centers of innovation and knowledge transfer, the importance of metropolitan areas is expected to continue to grow in coming decades.

While there is considerable data showing how metropolitan regions are the “economic engines” of the country and thus worthy of direct federal support, a major challenge of such assistance is recognizing that there are distinct local benefits of increased performance and quality of life as well. Thus efforts to devise efficient strategies for supporting metropolitan regions must separate returns on federal investment in achieving national goals from direct locally-based benefits and costs.

America’s economy is overwhelmingly located in metropolitan areas, and the future success of our economy will itself be tied to the economic vitality of these areas. Therefore, at the very least, spending should not discriminate against metropolitan regions. The trending economic reality that agglomeration economies cause productivity to be higher in urban areas makes

100 Jaffe, A. B., M. Trajtenberg and R. Henderson. “Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations.” *The Quarterly Journal of Economics*, 108 (3), 577-598. 1993.

it appropriate to structure transportation investments to assure that they do not disadvantage urban centers. As the country evaluates a nation-wide transportation strategy, it should not seek artificially to boost particular metropolitan areas. However, it should try to ensure that investments are balanced between rural and urban America.

Many analysts and legislators have characterized the problem as one of metropolitan “mobility,” a term that tends to emphasize traditional measures of traffic congestion.¹⁰¹ Mobility implies simply the ability to move more, a concept that does not necessarily capture

Our current ground transportation system is almost entirely dependent on oil for its energy needs

the economic benefits we seek. NTPP prefers to categorize the issue as one of accessibility. Accessibility is best defined as the potential for *interaction* and links to the notion of being able to complete an economic or social interaction in a timely manner. More choices, both in terms of available destinations and modes of travel, mean greater accessibility by most definitions.¹⁰² For our purposes, reliable access to services, employment opportunities, recreational activities, and social networks, among many other destinations is more critical than simply “being mobile.” Framing the challenge in these terms, rather than in terms of a narrow focus on congestion or decrepit transit infrastructure, is a critical first step

101 Transportation Research Board’s National Cooperative Highway Research Program. “Cost-Effective Performance Measures for Travel Time Delay, Variation, and Reliability.” 2008. NCHRP Report 618.

102 Handy, Susan. “Accessibility- vs. Mobility- Enhancing Strategies for Addressing Automobile Dependence in the U.S.” May 2002. http://www.des.ucdavis.edu/faculty/handy/ECMT_report.pdf

toward developing effective solutions that maximize long-term benefits to the economy and to people's quality of life.

Reforming national transportation policies and programs to be more attuned to the needs and critical importance of major metropolitan regions will be challenging, especially given that past programs have not been particularly designed to strengthen these areas.¹⁰³ Part of the difficulty is that these regions function as economic, rather than political units. By contrast, federal transportation programs targeted to urban areas (such as most transit programs) have usually been directed to specific projects and are typically fragmented along modal and jurisdictional lines. These programs offer useful lessons, but they have rarely looked to the performance or results of large, integrated multi-modal metropolitan transportation networks. A further complexity in designing a performance-based federal program to support metropolitan areas will be the need to distinguish local costs and benefits from the return on public investment with respect to national goals. Nevertheless these difficulties and complexities are well worth tackling given the many long-term benefits that would come with improved metropolitan accessibility.

Goal: Energy Security and Environmental Protection

We consider the objectives of energy security and environmental protection (more specifically, mitigating GHG emissions) as a single combined goal, in part because both issues relate directly to oil consumption in the transportation sector. Neither problem—energy security or climate change—can be addressed through transportation policy alone, but transportation plays a large role in both instances and thus presents significant

opportunities for advancing progress toward long-term solutions.

The crux of the challenge, from a transportation policy perspective, is that our current ground transportation system is almost entirely dependent on oil for its energy needs—various types of petroleum-based fuels supply 96 percent of total transportation-related energy consumption; conversely, transportation uses account for 70 percent of the economy's total oil consumption.¹⁰⁴

Climate objectives cannot be achieved without a focus on transportation technologies and related infrastructure.

Despite the many advantages of conventional petroleum as a portable, energy-dense, and relatively inexpensive transportation fuel, it is also non-renewable, emits carbon dioxide when combusted, and has no current substitutes that are cost-competitive and available at the scale required to meet a large share of current and projected transportation energy needs.¹⁰⁵ As already noted in Chapter II of this report, U.S. dependence on oil—a growing share of which, given flat or declining domestic production, must be imported from overseas¹⁰⁶—also gives rise to a set of interconnected

¹⁰⁴ US Energy Information Administration. "Annual Energy Review 2007." http://www.eia.doe.gov/emeu/aer/pecss_diagram.html

¹⁰⁵ Significant efforts to develop petroleum alternatives, including biomass-based fuels, have been underway in recent years. Some of these alternatives, including relatively new options such as algae-based petroleum, have shown promise but most remain unproven at the level of commercial-scale production. Others compete with agricultural lands and products, sometimes increasing their cost and scarcity.

¹⁰⁶ In 2007, U.S. domestic oil production totaled 6.88 million barrels per day, transportation consumption totaled 13.92 million barrels per day, and imports totaled 12.07 million barrels per day. See U.S. Department of Energy, Office of Transportation Technologies, Center for Transportation Analysis, Energy Division, Oak Ridge National Laboratory. "Transportation Energy Data Book – Edition 27." 2008. ORNL-5198. Table 1.12. Citing: U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review, February 2008*, Washington, DC. Table 3.3a

¹⁰³ American Public Transportation Association. "Counting Transit So That Transit Counts." May 2004. http://www.apta.com/research/info/online/counting_transit.cfm

economic and national security concerns. Again, these concerns have less to do with the specific share of U.S. oil consumption that is supplied by imports¹⁰⁷—rather they reflect our economy’s general exposure to oil prices that are set in a world market where demand until recently had been growing strongly and where supply conditions can fluctuate dramatically as a result of political upheaval, natural disasters, and financial instability elsewhere in the world.¹⁰⁸ The balance-of-trade and pocketbook impacts of this exposure are obvious when prices are high, as they were prior to the current economic recession, but our dependence on oil also gives rise to significant (though less easily calculated) liabilities in terms of geopolitical relations and U.S. expenditures to maintain stability and protect supply routes in volatile oil-producing regions of the world.¹⁰⁹ To address these

107 Even if the U.S. could supply 100 percent of its oil consumption using domestic resources, other countries’ dependence on oil in a globally inter-connected world economy would create domestic liabilities. In other words, so long as its allies and key trading partners are exposed to oil price and supply risks, the United States is too. Thus our national security interest in maintaining stability in key oil supply regions is only weakly connected, at least in the short run, to how much oil we are importing and from which countries.

108 The United States has little ability to influence world oil prices by increasing production because its domestic oil resources account for less than 3 percent of the world’s proved reserves. Rather, as the world’s largest consumer of oil, the United States is in a much stronger position to stabilize global oil markets and put downward pressure on prices by reducing domestic demand. See Energy Security Leadership Council. “A National Strategy for Energy Security.” Sep. 2008. http://www.secureenergy.org/files/files/936_SAF_986%20Recommendations_AW8_WEB.pdf

109 According to various estimates, U.S. military expenditures for defending oil supplies in the Middle East range from \$6 to \$60 billion per year, based on studies conducted over the period 1990 to 2003. [1] U.S. General Accounting Office. “Southwest Asia: Cost of Protecting U.S. Interests.” GAO/NSIAD-91-250, Washington, DC, August 1991. [2] Congressional Research Service. “The External Costs of Oil Used in Transportation.” Prepared for the U.S. Alternative Fuels Council, Washington, DC, June 1992. [3] Greene, D.L., and P. Leiby. “The Social Costs to the U.S. of Monopolization of the World Oil Market, 1972-1991.” ORNL-6744, Oak Ridge National Laboratory, Oak Ridge, TN, March 1993. [4] Kaufmann, W.W., and J.D. Steinbruner. “Decisions for Defense: Prospects for a New Order.” The Brookings Institution, Washington, DC, 1991. [5] Ravenal, E.C. “Designing Defense for a New Order: The Military Budget in 1992 and Beyond.” Cato Institute, Washington, DC, 1991. [6] Delucchi, M.A., and J. Murphy. “U.S. Military Expenditures to Protect the Use of Persian-Gulf Oil for Motor Vehicles.” UCD-ITS-RR-96-3 (15), University of California, Davis, California, April 1996. [7] Copulas, Milton R. “America’s Achilles Heel – The Hidden Costs of Imported Oil.” National Defense Council Foundation, Washington, DC, October 2003.



liabilities it will be necessary not simply to reduce America’s dependence on foreign oil, but to reduce *global* demand for oil. As the world’s largest consumer of oil, the United States is in a position to make a substantial contribution toward that objective by reducing domestic consumption over time.¹¹⁰

Reducing oil consumption, in the United States and globally, will also be necessary to address climate change. At approximately one-third of U.S. net greenhouse gas emissions¹¹¹ and about 7 percent of global emissions,¹¹² significant cuts in transport-sector oil consumption will be unavoidable if widely discussed atmospheric stabilization goals are to be achieved. The Intergovernmental Panel on Climate Change (IPCC), for example, estimates that global carbon dioxide emissions will need to be reduced at least 50 percent from 2000 levels by mid-century (2050) to avoid an increase in

110 Sandalow, David. “Freedom from Oil: How the Next President Can End the United States’ Oil Addiction.” 2008.

111 U.S. Environmental Protection Agency. “Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2007.” 15 April 2009. <http://www.epa.gov/climatechange/emissions/usinventoryreport.html>

112 Calculated using data from: 1) U.S. Environmental Protection Agency. “Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2007.” April 2009. 2) Energy Information Agency. “International Energy Outlook 2008.” Sep. 2008. [http://www.eia.doe.gov/oiaf/ieo/pdf/0484\(2008\).pdf](http://www.eia.doe.gov/oiaf/ieo/pdf/0484(2008).pdf)

global average temperatures of more than 2.4 degrees Celsius.¹¹³ Reaching that target globally, given expected growth in developing country emissions, will likely require even steeper reductions by industrialized countries like the United States. In fact, some recent proposals for national climate legislation in the U.S. Congress propose reductions on the order of 70–80 percent by 2050. Clearly, climate objectives cannot be achieved without a focus on transportation technologies and related infrastructure.

That the federal government has an essential role to play in addressing energy security and climate change concerns is self-evident insofar as both problems are not only national-level in scope, but have substantial international dimensions. Energy security has military and foreign policy implications that can only be addressed by the federal government, while carbon dioxide is truly a global pollutant, the impacts of which are completely independent of where it is emitted. Individual states and regions have, in recent years, have stepped forward to provide leadership in the form of innovative policies to address transport-sector oil consumption and greenhouse gas emissions, but no one expects that these initiatives can substitute for an effective national-level effort. The question, in sum, is less whether the federal government has a role to play on these issues, than it is whether and how federal policy on transportation can incorporate, as one of its central objectives, mitigating the nation's energy security and climate change threats. As reflected in the core principles we articulated previously, NTPP believes there should be a strong federal role in integrating energy security, climate change, and transportation policy rather than approaching these issues separately.

One compelling argument in favor of an integrated approach is that policies to improve the quality or ef-

iciency of transportation networks often also deliver energy and climate benefits. For example, policies that promote smoother traffic flow can ease congestion while simultaneously reducing gasoline consumption and greenhouse gas emissions. Policies that result in freight shifts from truck to rail transport can lead to the more efficient movement of goods while also reducing

There should be a strong federal role in integrating energy security, climate change, and transportation policy.

diesel consumption, road wear, and emissions. *In cases like these, where multiple problems can be tackled at the same time, the existence of co-benefits can substantially increase overall returns to public transportation investments.*

Another argument for integrating climate, energy, and transportation policy objectives is that a holistic approach is likely to be needed to fully tap the potential of the transport sector to reduce emissions and petroleum fuel consumption. As we noted in Chapter II, a policy to price carbon is essential, not only as a mechanism for creating market incentives to reduce emissions, but also to begin to signal to users some of the environmental costs of their transport choices. By itself, however, this policy is unlikely to produce sufficient reductions in transport sector oil consumption or emissions. Complementary technology policies, such as fuel economy standards for vehicles or funding for R&D programs, can help and are likely to be needed also, but even with their inclusion we are likely to fall short of tapping the full range of measures available for addressing transport-sector emissions. A more comprehensive strategy that makes use of other policy levers and incentives, including land-use

113 Intergovernmental Panel on Climate Change. "Climate Change 2007: Synthesis Report." Fourth Assessment Report. 2007. Table 5.1

decisions, electrification, user fees, modal options, and infrastructure choices, can be more effective while reducing the costs of achieving any given greenhouse gas reduction target. Finally, opportunities for mutually reinforcing policies go both ways. If a carbon pricing policy were to be put in place—whether in the form of a cap-and-trade system or carbon tax—it would generate revenues. At least a portion of these revenues should be directed to advancing transport-sector technology solutions and providing incentives for climate-friendly transportation policies and infrastructure investments.

The Minnesota Department of Transportation’s Office of Investment Management estimated that the cost to road-users as a result of the unavailability of the I-35W Mississippi River crossing totaled \$400,000 per day.

The concept of including environmental goals as a component of national transportation policy is shared by other countries. For example, one of Canada’s three objectives calls for “an environmentally responsible transportation system that contributes to Canada’s sustainable development objectives.” Similarly, the United Kingdom includes as one of four strategic objectives “to improve the environmental performance of transport and tackle climate change” and Sweden lists contribution to environmental quality goals as one of six sub-goals. Interestingly, none of these countries mentions energy as a specific goal.

Goal: Safety

As discussed in our review of current safety policies in the previous chapter, highway accidents account for the vast majority of transportation-related deaths and injuries in this country. And while travel on American roads is significantly safer than it was several decades ago, the human and economic toll from highway accidents remains higher than those in other comparable nations.

Already available data and research point to three major opportunities for further reducing highway fatalities. First, more than half (54 percent) of the passenger vehicle occupants killed in highway accidents in 2007 were not wearing seatbelts. Second, almost one-third (32 percent) of fatalities occurred in accidents that involved alcohol-impaired driving (defined as a blood alcohol concentration of 0.08 grams per deciliter or greater).¹¹⁴ Third, almost two-thirds (63 percent) of motorcyclists killed in states without universal helmet laws were not wearing a helmet—compared to only 14 percent of motorcyclists killed in states with helmet laws.

Another aspect of transportation safety concerns the potential for catastrophic system failures, including failures involving bridges, tunnels, or other major infrastructure. While such failures are relative rare, their impact tends to be disproportionately large (even if there are relatively few fatalities) because of their strategic transportation significance. When the I-35W Mississippi River Bridge collapsed in Minneapolis in August 2007, 13 people were killed. The bridge had an average annual daily traffic (AADT) of 140,000. Shortly after the collapse, the Minnesota Department of Transportation’s Office of Investment Management estimated that the cost to road-users as a result of the unavailability of the I-35W

¹¹⁴ Department of Transportation, National Highway Traffic Safety Administration. “Motor Vehicle Traffic Crash Fatality Counts And Estimates of People Injured for 2007.” Sep. 5, 2008. <http://www.nhtsa.dot.gov/portal/site/nhtsa/menuitem.6a6eaf83cf719ad24ec86e10dba046a0/>



Highway safety is an appropriate focus for federal transportation policy, not only because protecting its citizens is one of the core responsibilities of any national government, but because the federal government has the unique capability not only to set safety standards, but to set in motion better methods of measuring and improving safety. The technology needed to accurately track and improve safety performance exists, but it is unlikely to be implemented without active federal efforts to promote progress in this area. A new and potentially promising area for federal leadership in this regard involves research and standard-setting for the development of smart car/smart road connections, including the potential for integrating on-board technology and GPS (global positioning system) technology to improve safety, possibly in combination with pricing mechanisms.

Mississippi River crossing totaled \$400,000 per day.¹¹⁵ This figure does not include costs to other modes of transportation or to local businesses, nor does it include the costs of death, injury, property damage, rescue, recovery, demolition, or debris removal. Replacing the bridge cost \$234 million, and by the time it re-opened the total cost to road-users had reached approximately \$200 million. A distinct, though related issue is the potential for terrorist attacks on transportation infrastructure that could cause devastating human and economic losses. This is obviously a critical issue and one that has garnered new attention since the September 11 attacks. We do not include it as a specific goal here because providing this type of security is a complex challenge that requires data and competencies not generally found at DOT or in state transportation authorities. However, transportation agencies should (and typically do) work with security departments to address security issues related to transportation infrastructure.

115 Minnesota Department of Transportation website. See section entitled 'Economic impacts of the I-35W Bridge collapse.' <http://www.dot.state.mn.us/i35wbridge/legislative/#economic>



More difficult but absolutely essential to the actual implementation of a new approach is defining performance metrics that can be used to measure progress toward federal policy goals.





V. Performance Metrics for Measuring Progress on National Goals

Articulating national goals is only the first step in bringing a new focus on performance and accountability to U.S. transportation policy. More difficult but absolutely essential to the actual implementation of a new approach is defining performance metrics that can be used to measure progress toward federal policy goals. Such metrics provide the objective fact-base needed to prioritize among competing transportation investment needs, assess inevitable trade-offs, and hold recipients of federal transportation funds accountable for results. Accordingly, NTPP members devoted considerable time and discussion to the central challenge of identifying and developing performance metrics appropriate to each of our five primary national goals. This chapter describes our findings with respect to proposed performance metrics for federal transportation policy.

At the outset it is worth highlighting two features that are particularly important in designing effective performance metrics:

- First, performance metrics should be applicable across all modes to encourage an unbiased, mode-neutral approach to transportation investment decisions.
- Second, performance metrics should be applicable to a complete transportation program rather than to individual projects. Additional detailed technical analyses may be applied to individual projects within a program

NTPP recommends eight comprehensive performance measures for evaluating the progress of transportation programs towards achieving defined national goals. These metrics are intended to work together, not in isolation. Although one metric or another could be emphasized in a given funding mechanism, none of them can be minimized, discarded, or ignored when evaluating programs of projects. Those programs that perform best according to these metrics—that is, those programs that achieve the largest beneficial impacts at the lowest cost—should be preferred.

The metrics we propose are grouped in three broad categories that encompass economic growth, energy security and sustainability, and safety. Within the category of economic growth, we propose two metrics each under the two subheadings of national connectivity and metropolitan accessibility. For reasons discussed in the previous chapter, both of these are important national goals in their own right, as well as reasonable proxies for the more general objective of ensuring that our transport systems support economic growth.

Economic Growth

Metropolitan Accessibility

1. Access to jobs and labor
2. Access to non-work activities

National Connectivity

3. Network utility
4. Corridor Congestion

Energy Security And Environmental Sustainability

5. Fuel consumption
6. Carbon dioxide (CO₂) emissions

Safety

7. Fatalities and injuries per capita
8. Fatalities and injuries per 100 million vehicle miles of travel

As the foundation for a performance-based approach to federal transportation funding, it is critical for these performance metrics to be fair and free of bias toward any particular mode or region. In addition, they must be designed so that they can be included in Congressional legislation and used to evaluate scores of transportation programs nationwide. This has meant limiting the number of metrics and keeping them as simple as possible in order to make the overall approach workable and understandable. Based on past experience, it is likely that, with use over time, these metrics will be refined and become more sophisticated. The discussion here aims to provide a starting point—it is in no way intended to represent the final word on this subject. On the

contrary, we recommend that the performance metrics be refined and periodically updated as they become better understood and as more research is conducted, better data are collected, and federal programs adjust to a performance-based system.

Accessibility measures also better reflect the interaction between transport systems and land use. By contrast, measures of mobility focus solely on the quantity of transportation services provided.

Goal: Economic Growth

Progress toward the overarching goal of economic growth is as complicated and difficult to measure as it is important. Determining the economic benefits of a particular transportation program is also difficult, even using the four relatively simple metrics we propose, and it never produces a definitive result. Nonetheless, applying simple proxies for this goal is preferable to ignoring economic benefits altogether when making decisions about transportation investments.

Because the goals of national connectivity and metropolitan accessibility are directly related to economic growth we group all of these metrics together under the heading of economic performance.

ACCESSIBILITY AS A PROXY FOR ECONOMIC GROWTH

There is little argument that wise transportation investments can have significant positive impacts on the economy. The Interstate Highway System itself

provides strong evidence for this claim. While research on these benefits has been conducted at the regional level, requiring that all federally supported projects be subjected to a regional economic study would be costly and time consuming. Instead, accessibility measures provide an excellent proxy because they are critical to trade flows and to a country's competitiveness, and can be evaluated with relative ease and simplicity.¹¹⁶

For example, extensive analysis by researchers at the University of Minnesota identifies accessibility measures as comprehensive metrics for measuring transportation benefits.¹¹⁷ The Eddington UK transport study also found that access improvements are critical to trade flows and to a country's competitiveness with respect to exports and imports,¹¹⁸ while a separate study in France found that transportation costs and additional benefits can be evaluated by looking at the effective size of an urban area's labor market.¹¹⁹

Accessibility measures also better reflect the interaction between transport systems and land use. By contrast, measures of mobility focus solely on the quantity of transportation services provided, while measures of land use tend to focus on density and/or sprawl without accounting for access to transportation. In fact the two measures—mobility and land use—are best considered together when evaluating the merits of transportation investments.¹²⁰ In sum, accessibility focuses on the end

result of transportation system enhancements: That is, do people have reliable access to the services and activities that they need or want to get to? Congestion reduction is one component of increased accessibility,¹²¹ but access measures may also target transit improvements, demand management, land-use policy, and other options. Proposed transportation programs should be required to show how these combinations can increase accessibility.

PROPOSED ECONOMIC GROWTH METRIC 1: ACCESS TO JOBS AND LABOR

PROPOSED ECONOMIC GROWTH METRIC 2: ACCESS TO NON-WORK ACTIVITIES

Given that accessibility is an excellent proxy for economic growth, it is useful to distinguish between two different types of access: access to jobs and labor and access to non-work activities. The former, which inherently also measures congestion and reliability, is simple to understand and its connection to economic benefits is intuitively obvious, though it may be complex to calculate (as discussed below). Unlike more traditional level-of-service measures, it is not mode-specific and can be applied across a region of any size. Large urban regions have more jobs and labor to access, but must also spend more to improve that access. Less populous areas, by contrast, have fewer jobs and workers to connect, but improving access is relatively inexpensive.

Much of the economic activity that transportation directly or indirectly supports, however, is not related to work.¹²² In fact, work travel time as a share of all travel time has been shrinking.¹²³ This is why we also propose using a measure of access to non-work activities, underscoring the importance of considering access to

116 United Kingdom Department for Transport. "The Eddington Transport Study: The Case for Action." 2006. Volume 3.

117 The University of Minnesota Department of Civil Engineering. "Access to Destinations: Development of Accessibility Measures." Research completed for the Minnesota Department of Transportation. Report No. MN/RC-2006-16.

118 United Kingdom Department for Transport. "The Eddington Transport Study: The Case for Action." 2006. Volume 3.

119 Remy Prud'homme and Chang-Woon Lee. "Size, Sprawl, Speed, and the Efficiency of Cities." Nov. 2001. <http://www.dublinpact.ie/word/Prudhomme-paper.doc>.

120 Dr. Chandra Bhat. The University of Texas at Austin. Phone interview. Aug 7, 2008.

121 David Hartgen. 2007 Access to Destinations Conference.

122 Anne Canby. 2007 Access to Destinations Conference.

123 Kay Axhausen. 2007 Access to Destinations Conference.

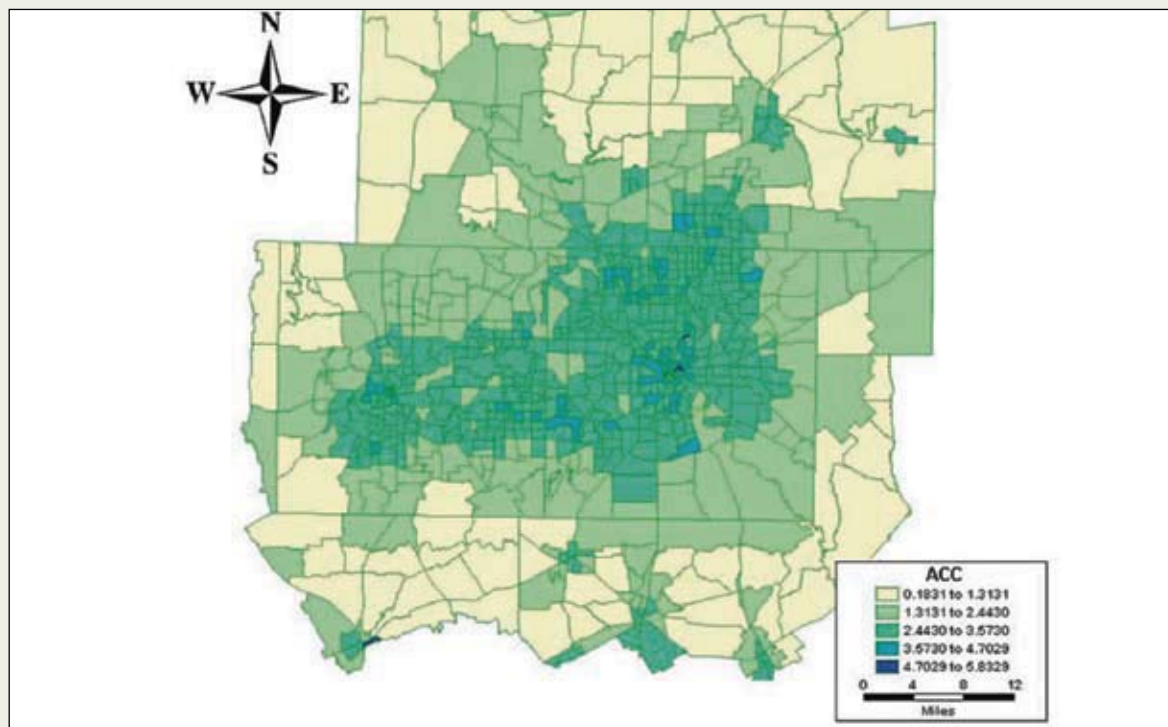
non-work destinations, such as hospitals, universities, parks, and other recreational opportunities. Moreover, a performance metric that captures non-work travel can help to emphasize programs that improve neighborhood accessibility. For example, new sidewalks can increase the desirability (not to mention safety) of pedestrian travel, which in turn can have a positive economic impact on local shopping, restaurants, and other non-work activities. Including access to non-work activities as a metric ensures that such benefits will be accounted for in an evaluation.

The argument for measuring accessibility is relatively straightforward—actually making the calculations,

however, is more complicated. Economic theory assumes that people make choices among alternatives that benefit them or provide them with what they want (termed utility). We propose to use a utility-based model to measure accessibility.¹²⁴ The model simply uses existing surveys to measure the value that individuals ascribe to each mode based on actual travel. These values are then added up across travel options within a region to measure the ease of access to various locations.

124 For measuring accessibility, a maximum utility measure is recommended to properly capture the components of travel choice. The maximum utility measure uses a discrete choice approach and is based on the multinomial logit (MNL) model. This type of model is commonly used in transportation planning and is also common in marketing, where companies identify target markets through models of consumer choice.

Figure 8: Accessibility Measures Modeled for Dallas-Fort Worth Metropolitan Area

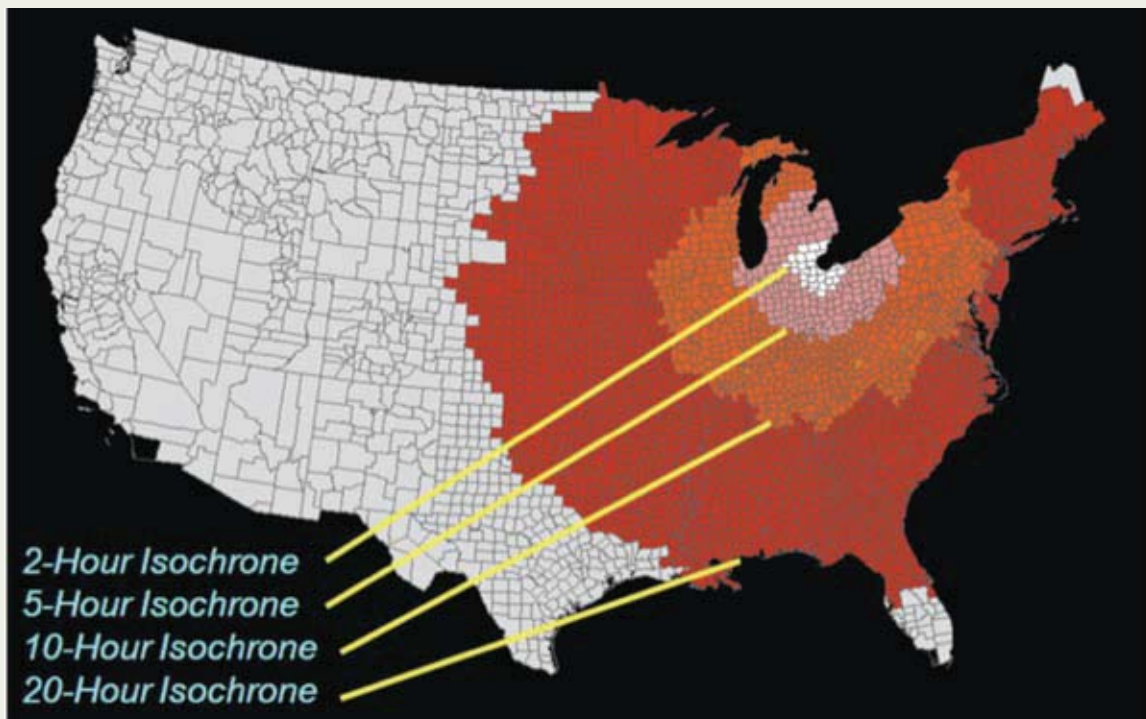


The utility-based model is the best available tool for this purpose because it takes into account the complex decisions and mode choices travelers make, including congestion and delays. This type of model can generate a summary measure of how many jobs and how much labor can be accessed within various periods of time for an entire region, as well as for smaller areas or neighborhoods. Figure 8 shows an example of this model applied to the Dallas Fort-Worth area. The “ACC” measure in the bottom-right corner is a scale of accessibility going from 0-6, with corresponding colors on the map as indicated. Proposed transportation programs in Dallas could be evaluated based

on how much they improve these measures across a given area.

While no analytic breakthrough is required to generate these access measures, some time may be needed for each state and metropolitan region to become comfortable with the calculations. These are not calculations that states and metropolitan areas are used to performing and there may be some lag before they are comfortable with doing so on a regular basis. Absent a federal “push,” however, state and regional authorities are unlikely to ever develop the capacity needed to become familiar and practiced with this approach.

Figure 9: Isochrones showing areas that can be reached within a given time period from Toledo, Ohio in a congested scenario



PROPOSED ECONOMIC GROWTH METRIC 3: NETWORK UTILITY

The next two metrics attempt to get at the goal of national connectivity. Here, we propose to measure two distinct factors. The first is aimed at understanding how well the transportation system connects different points of economic activity to one another on a national scale—we call this measure “network utility.” It helps to identify routes that should be connected more directly or where additional links are needed. Second, we propose a measure to evaluate performance on specific routes or corridors—hence “corridor congestion.”

The “network utility” metric would evaluate what percentage of population and goods can be accessed by the network within a given period of time. Applied to a proposed transportation program, for example, this metric could be expressed as population and freight accessible via the network within ten hours. This approach could be implemented for all freight travel to show access to intermodal facilities, airports, and/or ports within a given timeframe.

The concept of network utility can be shown graphically using isochrones—lines on a map connecting all points that can be reached in the same timeframe by available transportation from a given center (see Figure 9).¹²⁵ Network utility on the national network can be evaluated using cumulative opportunity isochrones, which evaluate the population or freight accessible within a certain period of time. As a baseline, such isochrones could be calculated for major nodes along the National Highway System (NHS), with at least one per state. To examine national linkages, the time frame should be measured in terms of days, rather than hours. To evaluate the connectivity benefits of a proposed transportation system investment, network utility after the improvement could then be compared to a status quo baseline.

PROPOSED ECONOMIC GROWTH METRIC 4: CORRIDOR CONGESTION

Although congestion mitigation is a goal that is effectively captured by the accessibility concept, and to some extent by the way we have defined “network utility,” it must also be explicitly recognized as an issue with direct implications for national connectivity. Accessibility measures, such as the ones we have proposed above, are inherently local in nature. To capture fully the broader connectivity benefits of proposed investments, we need to gain some understanding of how a given program will improve travel and delivery times on a larger scale.

That said, it would be extremely difficult to capture these benefits on a national scale, and there is no need to do so. Most new investments and policies, even if they are coordinated among states, are likely to primarily impact a specific geographic area or corridor. Programs should be evaluated based on how much they reduce congestion in the specific corridor or corridors they affect. Taking a corridor-specific approach will ensure that benefits in terms of congestion mitigation benefits will be captured effectively.

Of course, there will be some circumstances in which substantial congestion benefits occur outside the corridor where the investment takes place. For example, improving an airport access route could help to divert air traffic from a congested airport to an underutilized one, producing benefits for the national air system. These indirect impacts should not be ignored, obviously, and should be considered along with direct corridor benefits in the evaluation of programs or system investments. All of this will require much more consistent and robust interagency planning among and between state and local agencies.

¹²⁵ Basic cumulative opportunities measures do not rely on the utility-based accessibility model, as detailed in Appendix C: Understanding the Models.

Goal: Energy Security and Environmental Protection

We group energy security with environmental protection in this context because both objectives can often be advanced using the same strategy (particularly to the extent that climate change is understood to be the primary environmental impact of concern). Under this combined heading, however, we do propose two separate metrics—one focused on petroleum consumption, the other on CO₂ emissions—to address the possibility that some strategies to improve energy security could have adverse climate impacts (i.e., lead to *increased* CO₂ emissions). An example would be if efforts to promote domestic alternatives to conventional oil led to the increased use of fossil-based unconventional alternatives, such as fuels produced from coal, tar sands, or oil shale. In this case, the use of both metrics would ensure that one public policy objective is not unwittingly sacrificed in the pursuit of the other.

There are, of course, other important environmental impacts of concern besides climate change. We have chosen to propose a specific metric for climate change in part because there is a relatively strong consensus behind the superiority of a federal, rather than state or local, approach to addressing climate change – albeit the precise parameters of a federal approach remain subject to significant debate. We have also developed additional environmental measures that focus on air quality, water quality, habitat and ecosystem impacts, and noise and other community impacts. These are presented in Appendix A: Other Environmental Measurements. Neither those metrics, nor the metric we are proposing for climate change, are meant to substitute for existing federal environmental requirements under the National Environmental Policy Act, Clean Air Act, or the Clean Water Act.

PROPOSED ENERGY SECURITY METRIC: PETROLEUM CONSUMPTION

We recommend petroleum consumption as the best overall performance metric for assessing energy security benefits. States and metropolitan areas would be required to forecast the effects of their transportation programs on direct petroleum fuel consumption (gasoline and diesel). This metric is straightforward, relates directly to the national goal of improving energy security, and captures the broadest range of energy-related transportation program impacts, including the net impact of changes in fuel efficiency, vehicle activity, and fuel type. Further, using petroleum consumption as a metric allows us to combine the impacts of passenger and freight travel and evaluate options on a mode-neutral basis. It is worth noting that we deliberately focus on total petroleum consumption, rather than petroleum imports. This is simply because, as discussed earlier in this report, the price volatility, energy, and national security concerns commonly associated with America's current oil dependence are not primarily dependent on how much oil we import as a share of overall consumption.

As a metric for evaluating energy security benefits, measuring only direct petroleum consumption by motor vehicles does have some shortcomings. For one thing, it may fail to capture upstream oil consumption associated with producing, refining, and transporting finished fuels.¹²⁶ It could also be criticized for failing to address the possibility that by reducing our use of conventional petroleum we may wind up substituting one type of dependency and vulnerability for another, particularly if the result is an increased reliance on other imported fuels such as Brazilian ethanol.

Despite these considerations, NTPP concluded that direct petroleum consumption is the simplest and

¹²⁶ It would also fail to capture oil used in the upstream production of other fuel alternatives such as electricity. The latter is not likely to be a significant issue, however, because oil is not widely used to produce electricity in the United States.

most appropriate metric for evaluating energy security benefits, at least for the near term. To the extent that reduced oil consumption means an increased reliance on other fuels, such as ethanol or electricity, the resulting diversification of the transportation energy supply mix would enhance energy security. Finally, the benefits of accounting for upstream oil consumption is likely not worth the added analytical complexity, so a simpler measure is preferred.

As a performance metric, quantifying petroleum fuel consumption is conceptually straightforward. Petroleum-derived gasoline and diesel currently supply more than 95 percent of transport-sector energy demand.¹²⁷ Consumption is measured in gallons. When subdivided by fuel type, consumption figures can be easily converted to barrels of petroleum. Petroleum consumption itself can be calculated by multiplying estimates of VMT by estimated average vehicle fuel economy for major categories of vehicle types. Data on motor vehicle fuel economy are available at a national level from the Bureau of Transportation Statistics (BTS). On the other hand, estimating the petroleum consumption impacts of different policy strategies can present some technical challenges, particularly where the strategies being examined involve changes in vehicle operating conditions and where impacts must be measured at a regional level.

First, there is very little data on fleet fuel efficiency aggregated at the state or local level. Second, although data on state-level petroleum consumption are available through fuel tax records, this information may only be useful for estimating baseline fuel consumption and not for tracking or monitoring the effects of a transportation

project or program over time. Even for purposes of generating a baseline estimate, state-level fuel sales data are imperfect, since fuel is not always consumed in the same state where it was purchased. This is particularly true in metropolitan regions that straddle state boundaries and in smaller states. In the freight industry, long distance trucks may obtain fuel in one state and cross one or more states before refueling. “Boundary issues” such as these become more pronounced at smaller geographic units. In the case of large trucks, there is a national database of apportioned truck fuel use that allocates fuel sales taxes to areas of actual use that can counteract these potential issues. For the fleet as a whole, the Motor Vehicle Emissions Simulator (MOVES) model recently developed by the U.S. Environmental Protection Agency (EPA) should allow for improved estimates of petroleum consumption, even in smaller geographic areas.

PROPOSED CLIMATE CHANGE METRIC: CO₂ EMISSIONS

A performance metric based on CO₂ emissions is recommended as an intuitive and simple proxy for climate change impacts. CO₂ emissions account for the majority (95 percent) of transportation-related greenhouse gas emissions and are easy to calculate from available information on fuel consumption: All one needs to know is the quantity of fuel consumed and its carbon content. By contrast, estimating emissions of other types of greenhouse gases, such as methane, nitrous oxide, or hydrofluorocarbons, requires specific information and a number of assumptions about VMT by vehicle and technology type and other factors. Given the dominance of carbon emissions from direct fuel combustion in a transport-sector context, the additional complexity of including non-CO₂ emissions is probably not justified.

In contrast to the energy security performance metric discussed previously (where we propose to focus only on direct petroleum consumption), it is, however,

¹²⁷ The remainder is natural gas, used to power pipelines and motor vehicles (2.3%), renewables, which include alcohol fuels blended into gasoline (2.2%), and electricity (0.3%). Source: U.S. Department of Energy, Office of Transportation Technologies, Center for Transportation Analysis, Energy Division, Oak Ridge National Laboratory. “Transportation Energy Data Book – Edition 27.” 2008. ORNL-5198. Table 2.2.

important to account for upstream impacts in designing a climate change performance metric. This is because upstream impacts can be quite substantial for different types of fuel depending on the feedstocks and conversion processes used to produce the fuel. To calculate life-cycle CO₂ emissions, analysts must account for emissions from fuel production, refining, and distribution, as well as emissions from other sources, such as land-use changes. This can be technically complicated,¹²⁸ but fortunately a substantial literature exists on the subject and guidance is available for assigning upstream emissions factors to different types of fuels. Accounting for life-cycle emissions is particularly important when considering shifts from petroleum to other potential sources of transportation energy, such as electricity. Where a transportation program or policy results in greater use of plug-in hybrid electric vehicles or battery electric vehicles, for example, the CO₂ benefits will be much larger in locations where a larger share of electricity production is from low- or non-carbon sources such as renewables (e.g., wind, solar, hydroelectric) and nuclear. Conversely, benefits will be smaller or even negative where coal plays a prominent role in the power-sector supply mix.

DOTs and MPOs that have attempted to calculate GHG emissions from their transportation systems and plans typically start with CO₂ emissions before attempting to calculate other types of greenhouse gas emissions. Both the Maine DOT and the Metropolitan Transportation Commission (MTC), the MPO for the San Francisco Bay Area, have estimated the CO₂ emissions impacts of their long-range transportation plans.¹²⁹ In cases where strategies involve changes in vehicle speeds and operating characteristics, the new EPA MOVES model provides

outputs of CO₂ (as well as other GHGs) that are sensitive to vehicle speeds and operating characteristics.

The MTC, for example, has calculated CO₂ emissions as part of a regional-level analysis of alternatives for its 2035 Regional Transportation Plan. Proposed packages of investments were analyzed for their ability to reduce both VMT and CO₂ emissions. Packages considered included freeway investment with modest efficiency improvements, a high-occupancy toll (HOT) network with expanded express bus service, and an expansion of rail and ferry transit. MTC produced travel forecasts for these investment scenarios, as well as for a baseline investment scenario consisting of the area's most recent Transportation Investment Program (TIP). MTC further designed sensitivity tests based on an alternative land-use forecast and on a set of user-based transportation pricing strategies. A regional travel demand model was used to forecast vehicle activity in 2035 under each of the four investment scenarios using various combinations of the sensitivity tests. EMFAC2007, an emissions model used in California, was then used to calculate resulting CO₂ emissions.

Ultimately, the MTC concluded that both transportation pricing strategies and land-use strategies will be essential to meeting its CO₂ reduction target of 40 percent. The MTC is currently evaluating the CO₂ impacts of individual highway and transit projects as part of an analysis that will feed into a performance comparison of projects.¹³⁰

Goal: Safety

In contrast to the other performance metrics we have proposed, there is a long history of experience with measures of transportation safety. Nevertheless, safety is

128 The issue of upstream emissions is especially complicated in the case of biofuels, such as ethanol and biodiesel.

129 For more information on state and MPO efforts to quantify CO₂ emissions associated with the transportation plans and projects, see ICF International. "Integrating Climate Change into the Transportation Planning Process, Final Report." Prepared for Federal Highway Administration, July 2008. Available at: <http://www.fhwa.dot.gov/hep/climatechange/index.htm>

130 Metropolitan Transportation Commission. "Travel Forecasts for the San Francisco Bay Area 2009 Regional Transportation Plan Vision 2035 Analysis: Data Summary." Nov. 2007.

a complex subject that can be approached in a variety of ways and through a variety of mechanisms, including through different layers of government, the auto industry, emergency medical services, law enforcement, the court system, and individual driver behavior. Thus despite the availability of performance measures and relatively good data, demonstrating progress toward improved safety as a national goal can be very challenging for transportation providers.

PROPOSED SAFETY METRIC 1: FATALITIES AND INJURIES PER CAPITA

PROPOSED SAFETY METRIC 2: FATALITIES AND INJURIES PER 100 MILLION VMT

We recommend two metrics for evaluating safety impacts in the context of transportation policies and programs: number of fatalities and injuries per capita and number of fatalities and injuries per 100 million VMT. The former is important as it provides a clear understanding of the scale of the problem and can be used across all modes. The latter is important as it relates fatalities to the exposure to risk and focuses directly on the mode of travel with the greatest number of overall fatalities—the automobile. It is essential to use both of these metrics because they evaluate two different things – overall transportation safety and automotive safety.

Fatality and injury statistics are readily available via the General Estimates System (GES) maintained by the National Highway Transportation Safety Administration (NHTSA). Data for this system are obtained from a nationally representative probability sample selected from all police-reported crashes. To be eligible for the GES sample, a police accident report (PAR) must be completed, the crash must involve at least one motor vehicle traveling on a traffic way, and the crash must result in property damage, injury, or death. Although various sources suggest that about half the motor vehicle crashes in the country are not reported to police, the

majority of these unreported crashes involve only minor property damage and no significant personal injury.¹³¹ By restricting attention to police-reported crashes, the GES concentrates on those crashes of greatest concern to the highway safety community and the general public.

VMT is reported by the states as part of the Highway Performance Monitoring System (HPMS).¹³² Like NHTSA's fatality statistics, VMT is a well-established, widely understood measure. However, VMT data are based upon a sampling methodology and are often inaccurate. Moreover, VMT is one of a number of HPMS data items considered by FHWA to be a 'high risk subject area,' meaning it has a potential to significantly affect the apportionment of federal-aid highway funds, the biennial Condition and Performance Report to Congress, and FHWA's ability to provide required performance information. In other words, states may benefit if their reported VMT is too high. In the case of safety, an inflated estimate of VMT would result in an artificially lower fatality rate, possibly distorting the calculation benefits.

Closing Thoughts on Performance Metrics

It is important to keep in mind that all of the performance metrics we have proposed are designed to quantify the "benefits" one might expect from transportation investments. In all cases when these metrics are used to evaluate potential or actual expenditures, the "cost" side of the equation will have to be considered as well. While benefits are generally more difficult to estimate, the cost component is vital, since without it the metrics by themselves are virtually meaningless.

131 1) National Highway Traffic Safety Administration. "Traffic Safety Facts 2007." DOT HS 810 993. 2) Insurance Information Institute. <http://www.iii.org/media/hottopics/insurance/test5/>

132 Federal Highway Administration's Highway Performance Monitoring System website. <http://www.fhwa.dot.gov/policy/ohpi/hpms/hpmsprimer.htm>

In addition, a number of important limitations apply to all or most of the proposed metrics:

- **Data.** Severe deficiencies and uncertainties apply to the data available for evaluating transportation programs. However, the benefits of moving toward a transportation funding system based on performance far outweigh the drawbacks of working with poor data. As the data improve, the metrics can be refined to accommodate new and better information.
- **External factors.** The metrics we have proposed are inherently limited by the fact that they are subject to multiple external forces besides transportation policies and investments. For example, a chosen metric may be a good measure of economic growth, but the exodus of a particular business from a metropolitan area might have a greater impact on that metric than any transportation decision. Baseline issues—that is, distinguishing what happened as a result of the program being evaluated versus what would have happened anyway—can thus present a significant analytical challenge.
- **Forecasting models.** At the end of the day, states and other recipients of federal funds will have to use forecasting models to predict likely changes in the metrics as a result of federal investment. Although we believe we have chosen the best possible initial metrics, the models themselves are far from perfect and in the past have been subject to manipulation.^{133,134} Vigilance on the part of the states and the federal government will be essential to preventing these types of problems.

Two key points, both relating to the refinement of the performance metrics and how they operate, are worth emphasizing before we leave this topic. First, the case for different metrics presented here represents the beginning of the conversation rather than the end. Project evaluations under the New Starts program, for example, have been refined over the program's forty-plus years of existence to reflect both scholarly and political concerns. Although there are many problems with the New Starts program, in the end it produces a set of criteria for project evaluation that Congress recognizes as valuable and thus respects. This only occurred as the result of a sustained process of research and refinement.

Second, as noted above, data refinements are needed in order for these metrics to be useful. Although NTPP firmly believes that applying these metrics with the data that exist today is preferable to our current system, the metrics will become more fair and accurate as data improve. This too cannot happen without additional research; unfortunately, current research programs are not oriented towards this problem. In the next chapter we discuss the research and data problem more fully and provide some recommendations for how to remedy it.

Despite these limitations, the performance metrics we have proposed can provide a strong foundation for transitioning from the current system to one that rewards performance, innovation, and program-level planning. They provide a simple way to demonstrate results that is easy to understand and currently possible to measure. That these metrics suffer from the limitations we have noted only speaks to the fact that the federal transportation program has never used performance evaluation as a basis for distributing funds. Starting from scratch and developing performance measures is not trivial, but it is essential. The approach we have outlined in this chapter can provide a beginning.

133 Ethics and Advocacy in Forecasting for Public Policy. Dr. Martin Wachs. *Business and Professional Ethics Journal*. Vol. 9, Nos. 1 and 2.

134 How (In)accurate are Demand Forecasts in Public Works Projects? Bent Flyvbjerg, Mette Skamris Holm, and Soren Buhl. *Journal of the American Planning Association*. Vol. 71, No. 2, Spring 2005.



The new program structure outlined here—which is intended to fully replace existing surface transportation funding programs —will go a long way toward ensuring that future transportation funds are spent wisely and in accordance with specific national goals and performance measures.





VI

VI. A New Vision for Federal Transportation Policy

Building on the analysis developed in previous chapters, and particularly on the national goals and performance metrics proposed in Chapters IV and V, we turn in this chapter to a set of detailed recommendations for reforming and restructuring federal transportation policy. The new program structure outlined here—which is intended to fully replace existing surface transportation funding programs¹³⁵—will go a long way toward ensuring that future transportation funds are spent wisely and in accordance with specific national goals and performance measures. The consolidated structure we recommend is designed to provide assurance and accountability to users and funders of the system alike that public resources are being distributed in a way that maximizes public benefits and personal choice. We recognize that adopting a “clean slate” approach to transportation-policy reform is by no means easy and will encounter multiple obstacles. But the problems inherent in the current system, the imminence of Congressional debate on a new surface transportation authorization bill, the worst economic crisis in generations, and the lack of adequate funding availability from traditional resources have combined to create the urgency and the opportunity to undertake a totally new approach.

¹³⁵ Our recommendation for a clean slate approach that replaces all current funding programs does not preclude the need for some programs, particularly those pertaining to planning, research, and data collection, to be retained in a modified format. An example is the existing TIFIA program, which provides loans and loan guarantees for transportation projects, and which we would recommend be kept in place with some modifications.

Overview of Programmatic Recommendations

The comprehensive reform proposal described in this chapter is necessarily broad and consists of numerous specific components. Before delving into the details and by way of providing a road map for the reader, we begin by sketching the broad outlines of our approach (note that our chief recommendations are also summarized in the Summary of Recommendations section of this report).

First, we propose to consolidate current federal programs into two categories:

- Formula-based system preservation programs
- Competitive capacity expansion programs

System preservation programs would receive 75 percent of overall funds, the great majority of which would be distributed by formula, reflecting a recognition that preserving and enhancing existing infrastructure and systems—and thereby protecting past investments—generally offers the highest returns on public investment. The competitive capacity expansion programs would receive the remaining 25 percent of funds and would be focused on making the best possible investments in new infrastructure.¹³⁶

¹³⁶ Although we describe 100% of funding being split between these two types of programs, we also assume set-asides for planning, research, and data collection, as well as the possible retention of other programs that account for less than 1% of all federal spending on transportation.

Under the system preservation programs, we propose three new formula programs, plus an additional “bonus” program to reward exceptional performance:

- ***Sustaining national connectivity program (SConnect)***—would distribute funds on a mode-neutral basis to preserve and enhance systems (including highways and freight and passenger rail) that play a key role in assuring national connectivity, based on needs identified in the DOT conditions and performance report.
- ***Sustaining core assets program (SCA)***—would distribute funds on a mode-neutral basis to preserve and enhance systems in metropolitan areas with population greater than 200,000 people, based on economic output (GDP) and transit-miles traveled.
- ***Essential access program (EAP)***—would provide funds to states on the basis of population to ensure that transportation remains accessible for the underserved and disadvantaged.
- ***Performance bonus program (PBP)***—would provide additional funds to states and metropolitan regions based on their demonstrated progress in using formula funds to achieve national performance goals.

Redefinition of the federal system - the new formula programs would target a redefined and more focused federal system than we currently fund today.

Under the competitive capacity expansion programs, we propose two new programs:

- ***Improving federal connections (IFC)***—would provide funds to expand the national transportation network; DOT would evaluate applications and Congress would approve grants.

- ***Improving core transportation (ICT)***—would fund expansion of all transportation modes in metropolitan areas with population greater than 500,000 people, with a set-aside for smaller areas; DOT would evaluate applications and Congress would approve grants.

The organization of these programs in relation to one another, and the specific funding shares we envision for each program are schematically illustrated in Figure 10.

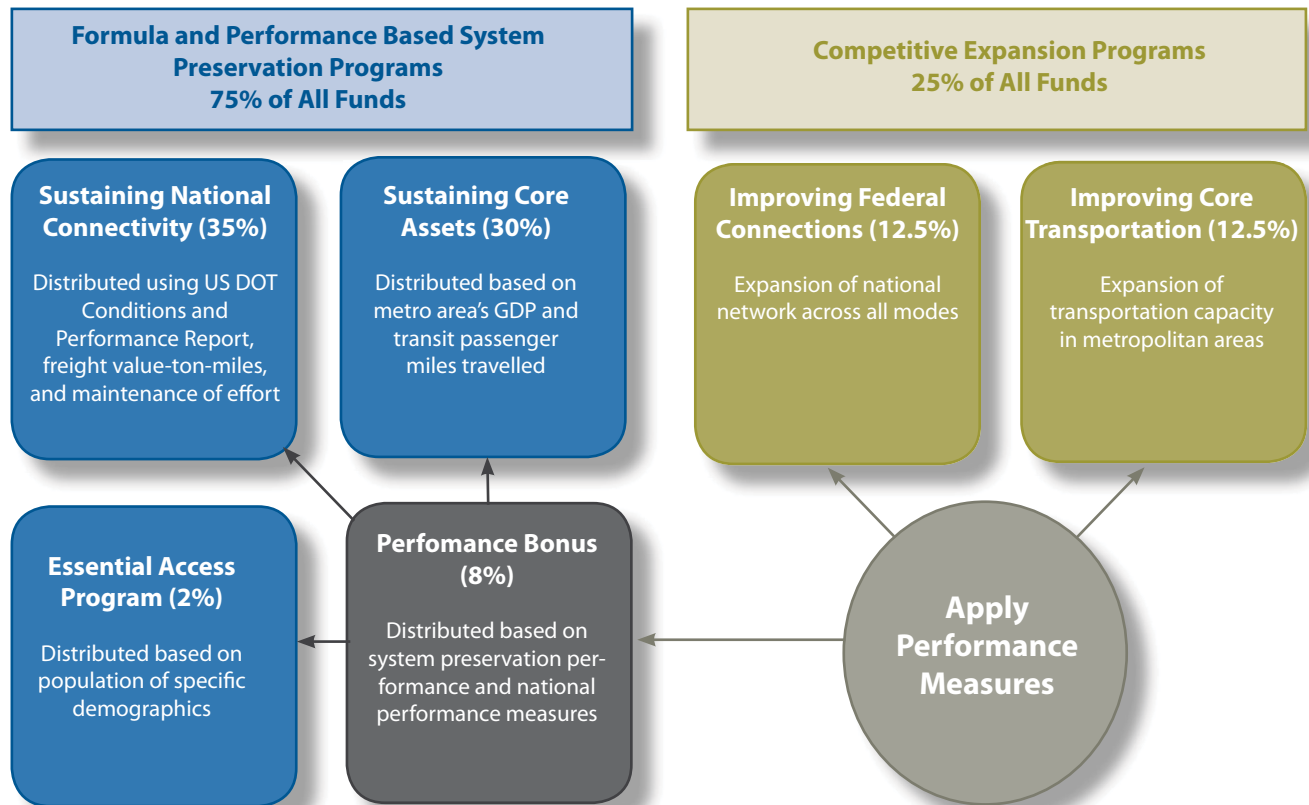
The success of the programmatic reforms we propose depends crucially on three other key inputs or conditions:

- ***Adequate and sustainable funding mechanisms***
- ***Institutional reform***
- ***Improved data for measuring performance***

Accordingly, the last sections of this chapter discuss our specific recommendations for addressing critical funding, institutional, and data needs.

Organization Recommendation: Change the Focus and Criteria of the Formula Programs

The current federal surface transportation program is dominated by several formula programs, under which federal funds are distributed to states and to transit agencies. Together, current formula programs (exclusive of the Equity Bonus program) account for approximately 65 percent of total federal highway authorizations and 67 percent of transit spending. Virtually any type of capital project is eligible under one of the dozens of formula programs currently authorized. The funds are distributed based on formulas that emphasize system use, including factors such as VMT, lane-miles, fuel use, and population.

Figure 10: Proposed Federal Funding Programs

Overall, NTPP recommends that largest share of federal surface transportation funding to states and localities continue to go through formula programs. However the formula programs must be completely reformed and consolidated to encompass a more focused and performance-based approach. In particular, the criteria currently used in formula programs are outdated and must be overhauled. In some cases, they create incentives that run directly counter to the national goals we have proposed—effectively rewarding growth in VMT or fuel use, for example. We envision a modally-neutral approach that allocates system preservation funds for the transportation system as a whole, rather than for highways and transit separately, and thereby provides

opportunities to address system preservation priorities in a holistic way, regardless of asset ownership or mode.

We recommend eliminating all current formula programs and replacing them with four new programs under the heading “formula based system preservation.” The two largest programs under this heading would be directed toward sustaining national connectivity and sustaining the core transportation assets of major metropolitan regions. NTPP also recommends a smaller formula program targeted towards providing access for disadvantaged members of society and an incentive bonus program to reward performance under the formula programs. Specific features of these programs are described below.

Central to our vision for all the new formula programs is a move to transparent decision-making at the state and metropolitan levels, and increased accountability in the use of federal formula funds to enhance overall system performance and reliability. The precise assignment of federal formula funds to highway or transit projects should be left to the state transportation agencies or to designated metropolitan regional decision-making bodies or processes. Planning and decision-making processes at the state and metropolitan levels must be strengthened in order to assure the development and implementation of plans that are genuinely strategic. (Later in this chapter we discuss the weakness of current planning processes at state and local levels and the limitations of institutional governance in most metropolitan regions.)

The new formulas used to distribute federal funds would rely on currently available data that are independent, consistent and simple, and that reflect an emphasis on transportation system preservation and performance. However, to be fully effective, the use of cost-based criteria will likely rely on asset management systems to provide accurate estimates of the conditions of each state and metropolitan system. State-of-the-art asset management systems already exist in some states and regions. The goal should be to complete a national asset management system capable of allocating formula funds by the middle of the next decade, in time for further rounds of legislation authorizing federal surface transportation programs. The major purpose of broadly-based and authentic asset management systems is to improve decision-making and priority-setting at state and local levels.

Consistent with a new emphasis on accountability, recipients of formula funds would also be required to track the results, including documenting how formula funds have restored transportation facilities and systems to a state of good repair and have enhanced overall

system performance consistent with national goals and performance measures.

As already noted, NTPP recommends that 75 percent of federal surface transportation funds be allocated to these formula programs plus the bonus program; moreover we recommend that this set of programs be the priority for any funds raised from the current fuel tax. *However, we also recommend that the overall percentage of funds distributed by formula should diminish over time as the backlog of system preservation needs is reduced.* This will eventually allow greater funding for system expansion through the competitive programs described in the next section.

System preservation programs should also allow for capacity expansions where this makes sense as part of an investment in improving the performance of an existing facility.

With the use of new formulas and a greater emphasis on accountability, the national interest will be well-served by federal funds distributed through the formula programs. However, the states and localities that receive these funds also benefit and must also contribute; indeed, there is an expectation that federal funds should not substitute for planned state expenditures. We recommend that all formula funds be distributed with the condition that federal funding will account for no more than 80 percent of any given system preservation project. NTPP recognizes that this may to some extent strain scarce federal resources, but we believe that concern is outweighed by the urgent need to establish clear federal responsibilities.

Figure 11: Transportation Investment Continuum



NTPP recognizes that the adoption of our recommendations would likely change the level of funding that specific agencies, regions, or corridors receive relative to current allocation rules¹³⁷ and may drastically alter which states do well under the federal programs. Therefore, it may be necessary to modify the new formulas with population factors that moderate any drastic changes. However, we strongly recommend against modifications based on factors such as VMT, fuel use, or rate of return.

Finally, while it is important to provide clear signals about likely long-term levels of federal funding so that agencies can plan accordingly, it is equally important to be clear at the outset that not all needs can be met. This is why we recommend two kinds of funding: a large base program that uses formula allocation and a smaller incentive-based funding program on top of that.

AN EMPHASIS ON SYSTEM PRESERVATION

There is strong evidence that improving the performance of existing transportation systems, including maintaining the physical and functional integrity of transportation facilities and assets and reducing the most serious bottlenecks and congestion, brings the greatest returns to investment in terms of economic

productivity, competitiveness, and sustainability.¹³⁸ In the context of limited resources, system preservation should therefore be the principal goal of most federal investment.

Investments in system preservation should be seen as part of a continuum (Figure 11) that is about more than ensuring smooth roads. Much of our current transportation infrastructure was built long before current uses were contemplated, and design standards differed at that time. System preservation today means upgrading and modernizing our facilities to meet contemporary performance requirements.

Accordingly, performance enhancement measures must be included within the allowable definition of system preservation activities, particularly in the context of the nation's aging transportation infrastructure. This broader definition of system preservation also reflects an effort to encourage cost-effective investments and to avoid a common situation where tight budgets force delays in the optimal cycle of repair and rehabilitation, ultimately adding to life-cycle costs and increasing the risk of system failures.

System preservation programs should also allow for capacity expansions where this makes sense as part of an investment in improving the performance of an

¹³⁷ This assumes that allocation criteria are not almost completely discarded, as they are now, in order to satisfy notions of geographic equity with respect to fuel tax revenues.

¹³⁸ United Kingdom Department for Transport. "The Eddington Transport Study: The Case for Action." 2006.

existing facility. Thus funds from these programs should certainly be available to reconstruct an aging bridge while simultaneously increasing capacity, or for purchasing new transit buses when old buses reach the end of their useful lives. They should not, however, be used to purchase new buses for new routes.

POLICY RECOMMENDATION: REDEFINE THE FEDERAL SYSTEM

This discussion of what should be included under system preservation brings up the issue of what we mean by the “system.” The NHS, which includes the Interstate Highway System, represents only one mode and is therefore unsuitable for our purposes. Moreover, it includes many facilities that are providing primarily local benefits and thus should not be eligible for federal funding to cover a majority share of their preservation costs. A more focused role for the federal government means not only emphasizing system preservation, but preserving what is truly a federal system.

Therefore, a wholesale re-examination of what is and what is not part of the federal surface transportation system is needed.¹³⁹ That system should include freight and passenger rail as well as highway infrastructure and should include access to ports and airports. Congress should appoint a bipartisan commission modeled after the Defense Base Closure Realignment Commission (BRAC), which was relatively successful in objectively deciding which military bases to close. The nation similarly needs to decide which elements of the NHS should be excluded from the federal system going forward, as well as which rail elements should be included.

It is this new redefined system that will be the target for formula funding. The formula funds intended to pre-



serve vital national connections must be used to reduce the maintenance backlog and improve the performance of this system. Once a consensus is achieved on the extent of the system, additional suggestions could be made regarding important bottlenecks. These targeted bottlenecks could then potentially be used as a method of funding distribution.

PROGRAM RECOMMENDATION: ESTABLISH NEW FORMULA PROGRAM FOR SUSTAINING NATIONAL CONNECTIVITY (SCONNECT)

NTPP proposes establishing a new formula program to focus on sustaining national connectivity under the heading of formula based system preservation programs. We call this program Sustaining National Connectivity or SConnect. It is intended to address the preservation of all surface freight and inter-city passenger services across all modes. It would include the entire Interstate Highway System in both urban and rural areas as well as the non-urban portions of a strategically redefined NHS, and would make funds available to preserve rail infrastructure for both passengers and freight.

Although the Interstate Highway System was constructed, reconstructed and expanded largely with federal funds, its elements have been owned and maintained by the various states. Thus a federal formula program intended to preserve and enhance the performance of this great national connecting system must necessarily involve distributing funds to the states that own and operate the facilities and systems contained within it.

139 1) Staley, Sam and Adrian Moore. “Mobility First – A New Vision for Transportation in a Globally Competitive Twenty-First Century.” 2009. 2) “21st Century Highways – Innovative Solutions to America’s Transportation Needs.” Edited by Wendell Cox, Alan Pisarski and Ronald Utt. Heritage Foundation. 2005.

A cost-based formula offers the simplest and most direct way of allocating federal funds under a national connectivity program. Such a formula can, at least initially, make use of the analyses already conducted by U.S. DOT as part of its bi-annual Conditions and Performance report.¹⁴⁰ This will mean distributing funds to states based primarily on the condition of those portions of the Interstate Highway System and of a redefined non-urban NHS that they own and operate. Minimum allocations would be provided for all states.

While the analyses used in preparing DOT's Conditions and Performance reports have data shortcomings and are not primarily designed to produce information to guide investment strategies, these analyses represent the best current information available on condition, and can serve as a foundation for developing more reliable and appropriate preservation criteria. Over time, better and more relevant data on the condition of these systems - including real-time data through the use of advance information technologies—should be developed. This new data will help to refine the distribution formula.

However, the new program we propose would also need to address eligible rail system preservation needs. Much of the data required to evaluate these needs is proprietary and therefore difficult to obtain. Therefore we recommend distributing additional funds under this program based on freight value-ton-miles within a state. Though not an ideal measure of preservation needs, this approach will at least target areas with significant high-value freight traffic and ensure that adequate public support is provided to keep that freight moving. A way to improve this measure might be to develop a consistent and objective measure of bottlenecks and congestion within the freight network, perhaps using volume-to-capacity ratios. It is also possible that a redefinition

of the federal system could include definition of and identification of bottlenecks and congestion. Further study is needed to develop such a measure, but it could help ensure that system preservation funds are targeted to areas where they can actually eliminate bottlenecks.

The primary purpose of this formula should be to target federal resources to the most essential national system elements in need of preservation. The definition of need, when applied to the national surface transportation system, differs from many other federal formula programs. Other federal programs sometimes intend to fulfill a shortfall where a state is not meeting the needs of its citizens adequately. By contrast, this formula determines the level of support for state programs with multiple benefits outside of each recipient's boundary. For example, the failure of an Interstate facility in one state would have negative impacts on the economies of several adjacent states. The intention is to target federal funds to those investments that are most necessary to preserve the national transportation system and enhance interstate commerce.

Even though the SConnect formula program is designed to target funds based on the preservation needs of a national system, any such formula allocation necessarily raises certain perverse and inappropriate incentives. It is probable that those states that have done the least to preserve and maintain the sections of these national systems of connectivity that lie within their borders will receive the most federal funds. Moreover, special circumstances and challenges to preservation are often not recognized in condition-based allocations. The SConnect formula, therefore, must ensure that states are not punished for good system preservation policies. To some extent this is accomplished by the Performance Bonus Program described below, but the initial distribution formula should also reward efforts by states that have implemented revenue-raising and asset management policies, and have undertaken invest-

¹⁴⁰ The HERS model can be used to calculate state distribution based on the Conditions and Performance Report.

ments to preserve those elements of these national systems that are located within their boundaries. Population, as well, might be used as a balancing factor in the formula allocations.

What would chiefly distinguish SConnect from current programs is a narrower conception of the NHS recommended above, and the ability to fund across additional types of modes and investments. Because rail systems are privately owned, making them eligible for federal funding under this new program would represent a profound departure from current practice, but we believe it to be essential. There are cases where system preservation investments that are in the public interest are not made because they are not justified by private returns to the railroad. SConnect funds could help fill that void by providing a public contribution commensurate with the public benefits in these instances. Federal funds would in no way be intended to substitute for private funding, and any public funds directed towards privately-owned networks would need to be matched by private investment. Because rail networks traverse multiple states, here again a new level of planning and cooperation between and among states will be required.

SConnect funds also could and should be used to improve the performance and operations of existing systems through intelligent transportation systems (ITS) technologies, congestion or variable pricing, policy changes, or any other method a state chooses. As we have already noted, we view system preservation as more than maintaining infrastructure in a state of good repair—we view it as also maximizing the efficient use of existing infrastructure.

To provide accountability for SConnect funds, states would be responsible for producing a State Preservation Plan (SPP) that describes how they plan to use formula preservation funds to reduce their maintenance backlog and improve system performance. Although the

trade-offs inherent in formulating such a plan would be entirely up to each state, this requirement would at least ensure that states think about the tradeoffs they are making. States would also be required to track and report expenditures to DOT retrospectively; these reports would then be used to allocate funds under the Performance Bonus Program described below.

PROGRAM RECOMMENDATION: ESTABLISH NEW FORMULA PROGRAM FOR SUSTAINING CORE ASSETS (SCA)

The second principal formula program we propose under the heading of formula based system preservation programs targets the preservation of metropolitan transportation systems and is called Sustaining Core Assets or SCA. It would focus on maintaining and enhancing the performance of core transportation assets—including regional highways, principal arterial roads, bridges, tunnels, commuter systems, and bus and rail transit (but not the Interstate Highway System¹⁴¹)—in the approximately 200 metropolitan regions in the United States with population greater than 200,000 people. For this program, a metropolitan-wide transportation agency—most frequently an MPO or a combination of MPOs—would be designated by the state to receive and redistribute federal formula funds to those agencies that own and operate transportation assets.

Ideally, SCA funds would be allocated on the basis of need. Unfortunately, information similar to that contained in the DOT Conditions and Performance report does not exist to support a cost-based allocation of funds for the preservation of metropolitan transportation assets. Therefore, funds under this program must be allocated on a different basis than SConnect.

141 Although the Interstate System would be covered under SConnect, it is expected that states will work with metropolitan authorities to address performance problems on that system in metropolitan areas. If they fail to do so, they will face substantial challenges in addressing performance and thus will be unlikely to receive performance bonus funds.

NTPP recommends using a rolling ten-year measure of metropolitan GDP to allocate federal preservation and performance funds. GDP would serve as a proxy for wear and tear on transportation infrastructure and provides a good measure of the economic importance of each region relative to the national economy. Metropolitan area GDP figures are reported annually by the U.S. Department of Commerce's Bureau of Economic Analysis (based on data collected two years prior to the report date).

Using a ten-year rolling GDP will help stop the bleeding aid metropolitan areas that have slower, declining, or stagnant growth. These areas often still have large system preservation needs, and should not be further penalized for having lost population and economic output.

However, even with a rolling GDP there is a remaining problem with this approach. Existing public transit systems in metropolitan areas vary tremendously in age and maintenance needs. Thus some areas may have large transit systems (such as the Chicago Elevated, for example) that have greater maintenance needs than newer infrastructure in other cities. These needs rarely correlate to share of GDP. Therefore we recommend providing a portion of SCA funds on the basis of transit passenger-miles.

NTPP does not recommend setting a minimum for SCA disbursements to smaller metropolitan regions, nor do we recommend capping the SCA funds that would be available to any one region. Rather, funds would be allocated across all metropolitan areas using the same basic formula. However, in states with no metropolitan area over 200,000, the largest metropolitan area in the state would qualify for funding under this program.

PROGRAM RECOMMENDATION: ESTABLISH NEW FORMULA PROGRAM FOR ESSENTIAL ACCESS (EAP)

The new formula programs we have described are designed to address system preservation needs with a strong emphasis on performance and accountability. However, federal aid currently helps to support a number of additional transportation services that might not be adequately provided under these programs. In general, the accurate application of our recommended performance metrics will ensure that the needs of economically disadvantaged, rurally isolated, or disabled individuals are better accounted for than they are today. Nevertheless, there is the possibility that services to these groups could be neglected without a specific government program designed to target them. Therefore we recommend that a single new Essential Access Program (EAP) be established to substitute for several current FHWA and FTA programs, including the following:

- **Safe Routes to Schools.** This program is intended to enable and encourage children, including those with disabilities, to walk and bicycle to school by making it safer and more appealing.
- **Transportation for Elderly Persons and Persons with Disabilities (5310).** This program assists private nonprofit groups in meeting the transportation needs of the elderly and persons with disabilities when other transportation services are unavailable, insufficient, or inappropriate for these individuals.
- **Transportation for Rural and Small Urban Areas (5311).** This program provides states with formula funding to support public transportation in areas with populations below 50,000.

- **Job Access Reverse Commute (JARC).** JARC funds projects designed to help low-income people access employment and related activities where existing transit is unavailable, inappropriate, or insufficient; it also funds reverse commute transit services that are available to the general public.
- **New Freedom Program.** This program aims to help Americans with disabilities overcome existing barriers to becoming integrated in the work force and participating fully in society.
- **Over the Road Bus Accessibility.** This program assists providers of intercity fixed-route service and other services (such as commuter, charter, and tour bus services) in complying with U.S. DOT accessibility rules for the disabled.

Our proposal for a new EAP formula program is intended to encompass all of the purposes outlined above. States could administer EAP funds as they do for current programs, but EAP would provide the consolidation needed to support greater local flexibility and mode-neutral application. All of the regulatory, non-discrimination, and planning requirements contained in existing programs would similarly be preserved.

The formula used to distribute EAP funds should include measures of rural, elderly, disabled, and economically disadvantaged populations. The program would be modeled after the JARC program listed above: funds would be distributed to states on a formula basis, but then states would administer the grant program on a competitive basis. Over time it will be essential for this program to incorporate relevant performance measures that evaluate how well the EAP is accomplishing its stated goals. The program can then be restructured so that future funding is conditioned on the demonstration of good performance.

PROGRAM RECOMMENDATION: ESTABLISH NEW PERFORMANCE BONUS PROGRAM (PBP)

Funds under the new formula programs we have described thus far would be distributed on the basis of need, as indicated by a cost assessment in the case of SConnect or by other factors in the case of SCA and EAP. In some ways this risks creating perverse incentives in the sense that states with greater needs may obtain a larger share of federal resources, while states that use their resources effectively to minimize needs are disadvantaged. The Performance Bonus Program or PBP is designed to counteract that possibility, while also encouraging investments that improve the performance of the existing system. Though not technically a “formula” program, we include PBP under the broad heading of formula programs because states’ ability to qualify for this “bonus” funding would entirely depend on the results they achieve using funds from the other formula programs.

The amount of the incentive bonus would be based on the following performance measures for all states:

1. Progress in reducing the backlog of projects needed for system preservation
2. Progress toward achieving overall system goals as measured by the performance metrics described in the previous chapter

It will be up to states to track expenditures and demonstrate—through actual not projected data—how their expenditures of federal formula funds have performed with respect to the objectives listed above. Each state wishing to receive a portion of PBP funds would submit its annual accountability report to U.S. DOT, which would evaluate them and submit recommendations to Congress regarding the allocation of PBP funds. Subject to Congress approving the allocation, states would have broad discretion to use PBP funds on any transportation

project they choose. However, to the extent that they use these funds to further improve performance they are likely to increase their allocation for the next year.

Organizational Recommendation: Consolidate and focus competitive federal programs

NTPP recommends eliminating all current discretionary programs and replacing them with two programs designed to provide federal funds for expanding the capacity of the nation's transportation system, contingent on a demonstration that federal funds will be used in a manner that advances national goals as measured using recognized performance metrics. We envision innovative, mode-neutral, and comprehensive programs competing with one another on the basis of federal performance metrics, and federal funding determinations being made on that basis.

Such a process would differ from the way in which most discretionary transportation programs operate today. First, current discretionary programs tend to have a project orientation, whereas we are advocating a programmatic orientation. This means that funds should not be targeted to specific capital projects but instead should support coordinated programs of investments, operations, and policy changes. This programmatic approach builds on the work of the Urban Partnership Agreements discussed in Chapter III.

A second key difference is that most current discretionary programs are fully earmarked by Congress. This earmarking represents a lack of confidence by Congress in the ability of the U.S. DOT to make objective funding decisions. We recommend a joint process whereby Congress specifies performance measures and then allows U.S. DOT to perform the objective analysis. When final DOT recommendations for funding are submitted to Congress, these would be approved assuming they are

consistent with the criteria Congress established. This approach builds off the work of the New Starts program, also discussed in Chapter III, which is one of the few discretionary programs where Congress, in making the final decisions, respects the criteria used by U.S. DOT in analyzing applications.

The success of competitive programs depends on finding the sweet spot between these two extremes, where programs are not excessively bureaucratic, but produce results that are accepted by Congress and aligned with national goals.

NTPP harbors no illusions about the difficulty of creating truly competitive, discretionary programs based on objective criteria. As we saw with the New Starts program, such a program would have high potential to become bogged down by the rigor of its own criteria, and could contribute to greater delays in project delivery. Avoiding excessive bureaucracy in such programs is a significant challenge. On the other hand, this must be balanced against the possibility that a streamlined program with much less rigorous requirements will produce sub-optimal outcomes and eventually lose the confidence of Congress. The success of competitive programs depends on finding the sweet spot between these two extremes, where programs are not excessively bureaucratic, but produce results that are accepted by Congress and aligned with national goals. Striking this balance is not only possible, but essential to the future effectiveness of federal transportation policy.

PROGRAM RECOMMENDATION: ESTABLISH NEW COMPETITIVE PROGRAM FOR IMPROVING FEDERAL CONNECTIONS (IFC)

Investment in the nation's great connecting corridors must advance national economic goals by filling critical gaps in the capacity of our national transportation networks, while simultaneously advancing national goals with respect to energy security, climate change, and safety. NTPP proposes a new, consolidated program of federal investment in capacity expansion called Improving Federal Connections or IFC. Funding from this program would support the expansion of nationally significant corridors, networks, and connectors across all modes and would address both freight and passenger needs. The program would focus on providing support for nationally significant, high-cost projects that require resources beyond the capacity of individual states or regions and that will generate broader economic benefits to the nation as whole. This program would account for 12.5 percent of federal surface transportation funding.

Program Structure

IFC funds would be available to states, regions, and localities—or to any collection or consortia thereof—that seek to implement, in coordination with the private sector, programs designed to advance these national interests. IFC would build upon Projects of National and Regional Significance (PNRS), the programmatic initiative introduced under SAFETEA-LU, and related programs. Though the PNRS program was intended to support private-public partnerships and regional collaborations (with the idea that federal grants would leverage and supplement state and local grants, private equity investment and lending, and public credit enhancements), in practice, funds under the program have been totally earmarked, no analytical process has been applied to grant requests, and no objective priorities have been established in awarding federal funds. However, programs like PNRS and the border and corridor

programs¹⁴², provided they can be kept free of earmarks, can serve as the basis for a new competitive, merit- and performance-based program.

The proposed IFC program would also provide a structural platform for assessing competing regional proposals for new infrastructure or capacity expansions with respect to intercity passenger rail or highway systems, bus improvements or air and sea port connections. The President's commitment to providing federal support for new high speed rail corridors—both in the stimulus package and in the Administration's 2010 budget proposal to Congress—would fit logically in this new, competitive mode-neutral structure. The IFC program we envision would incentivize and support collaborative regional planning, often crossing political boundaries, to identify new corridor links that will generate the greatest public benefits. This could include, for example, enhancing intercity passenger and freight connectivity to reduce highway congestion, energy use, and carbon emissions.

Eligibility for IFC funds would extend to any state, region, locality, or collection of those entities that applied for a grant to support programmatic approaches to expand and improve the performance of critical elements of the national transportation system. Proposals could and should include public-private-partnerships where appropriate. They would be evaluated by U.S. DOT and ultimately approved by Congress. Performance along all relevant metrics would be considered, with the national connectivity metric receiving the greatest emphasis. Recipients would be responsible for reporting afterwards on whether they accomplished program objectives as predicted, and future funding determinations could take into account past performance, positive or negative.

¹⁴² These programs are formally known as the National Corridor Infrastructure Improvement Program and the Coordinated Border Infrastructure program.

We envision that the federal share of each grant would be determined based on assessed federal interest. Without a pre-specified federal match, potential grantees will need to compete with one another in terms of the level of state and local resources they can contribute. It is important, however, that the level of state or local match not become the overriding consideration or one that weighs more heavily than performance with respect to advancing national goals.

Funding the IFC

NTPP would expect grant applications to the IFC to exceed available funds by many orders of magnitude. Various groups have developed “needs to improve” estimates, in some cases including very large single projects or brand new interstate corridors, each of which could require several hundreds of billions of dollars. Similarly, nascent high-speed rail corridor planning efforts have begun in at least ten areas of the country, each of which—assuming the new rights of way required to accommodate true high-speed rail, can be acquired—will easily cost out in the tens of billions of dollars. Therefore new sources of funding will be necessary to make this program function effectively.

We recommend that strategies for improving freight mobility be funded via a new fee on freight movements by all modes, as well as other transportation-related fees and some general funds. Additionally, given the strong emphasis on greenhouse gas emissions in our proposed performance metrics, revenues from any imposed cap and trade or carbon tax system should be made available for this program.

Projects to improve connectivity for passenger rail travel would be funded by seed capital from general funds. To the extent such projects demonstrate potential for significantly reducing energy use and greenhouse gas emissions, some revenues from a cap-and-trade program or carbon tax should also be applied. Private

financing and partnerships hold promise in these areas; accordingly, the existing tools of the TIFIA¹⁴³ credit program and private activity bonds could be expanded to facilitate private financing.

IFC Planning Framework for Identifying Priorities and Optimizing Results

To guide collaborative efforts, federal leadership will be needed to come to agreement on an independent, objective, evidence-based outline of nationally significant corridors. This would include (as discussed previously) first developing a criteria-based approach for identifying those portions of the NHS that have truly national significance. It would also mean identifying nationally significant freight corridors, gateways, and border areas as well as criteria for evaluating the likely costs and benefits of proposed new or expanded high-speed rail corridors. Moreover, given the diversity of development and trade patterns, a dynamic process will be needed to maintain and update this “map” of nationally significant connectors and trade corridors as a tool for prioritizing federal investments over time.

Applicants for IFC funding would be required to submit plans of sufficient breadth to demonstrate that a proposed corridor, region, or appropriate boundary is consistent with the program’s focus on improving national connections. An example could be multiple states sharing an economically significant corridor, or a broad region with a shared interest in a reconstructed and larger bridge. Plans should also be multifaceted—i.e., not confined to simply proposing a major capital expenditure—in order to maximize benefits according to the performance metrics. In other words, proposals to expand the capacity and improve the performance of a particular gateway, corridor, or border area should identify complementary strategies or initiatives to

143 TIFIA stands for Transportation Infrastructure Finance and Innovation Act. This legislation, enacted in 1998, established a federal credit program for eligible transportation projects.

optimize the impact and effectiveness of any proposed capital project. The scope of competing proposals and the breadth of collaboration they reflect are also likely to be important factors in a U.S. DOT assessment of their merits.

PROGRAM RECOMMENDATION: ESTABLISH NEW COMPETITIVE PROGRAM FOR IMPROVING CORE TRANSPORTATION (ICT)

NTPP proposes a new competitive program to focus on improving the core capacity and performance of metropolitan transportation networks with the aim of advancing economic growth and sustainability objectives in the nation's economic centers.

The Urban Partnership Agreements (UPA) program, a programmatic initiative undertaken by U.S. DOT that operated from 2006 through 2008, demonstrated that the federal government could partner with metropolitan regions to pursue national goals, while still supporting state and local initiative and flexibility. Perhaps the most significant element of UPA was that it led to competition among metropolitan regions for federal support, which in turn stimulated innovation in the use of public and private funds. Significant elements of this program included the following things we want to emulate:

- An emphasis on strategic, goal-oriented programs across modal and agency lines, rather than on the project- and mode-specific orientation of traditional federal transportation programs.
- The necessity for collaboration among all of the relevant public institutions and agencies in the applicant metropolitan areas.

As mentioned in Chapter III, while the New Starts program has been criticized for its lengthy, cumbersome, and overly bureaucratic application review process, it

does represent one of the few federal surface transportation programs that attempts to integrate federal objectives and a range of environmental, land-use, and financial considerations in the preparation and analysis of competing applications. The New Starts program also offers a model for our proposed approach of having U.S. DOT analyze and evaluate competing applications, and then make funding recommendations to Congress for final approval.

Program Structure

There are 100 metropolitan areas with populations over 500,000 in the United States (65 percent of the overall population resides in these areas). These large metropolitan areas would be eligible to apply for federal assistance under the ICT program we envision. In addition, a portion of available federal funding under this program would be set-aside for applications from metropolitan regions with populations between 100,000 and 500,000 (83 percent of the American population lives in metropolitan regions of 100,000 inhabitants or more). This program would account for 12.5 percent of all federal surface transportation funding.

In evaluating competing applications for ICT funding, the focus would be on “what” they achieve rather than on “how” they achieve it. As was demonstrated in the UPA program, flexibility at the state and local level combined with a bottom-up approach to program development and active competition for limited federal funds can stimulate innovation. Moreover, federal ICT funds could stimulate the investment of public and private funds at the state and local levels, potentially providing an ideal opportunity for increased private-sector cooperation in the financing and operation of new transportation infrastructure.

In analyzing applications and making funding recommendations to Congress, U.S. DOT would utilize all the metrics described in Chapter IV, but it would not weight

them all equally. Given that the program is designed to target metropolitan areas, economic metrics related to accessibility to work and non-work activities should be emphasized. As with the other new programs we have recommended, grant recipients should be required to track results and evaluate performance retrospectively, with the idea that these evaluations would inform decisions on future applications.

Since there are shared national, state, and local interests in improving the capacity and performance of metropolitan transportation networks, federal ICT funds should be complemented by state, local, and private resources. Non-federal support should be considered in the evaluation of competing applications for ICT funding, similar to current practice under the New Starts program. A variable federal match should serve to encourage greater emphasis on local funding as well as more intense competition and innovation. As with the IFC program, however, the level of non-federal resources should not be the overwhelming consideration in deciding among grant applications, nor should it override considerations of merit according to our performance metrics.

ICT Planning

The strategic planning capacity and organizational structure necessary to implement the new programs we propose theoretically exists at the state level (more on this in the final section of this chapter). Unfortunately, however, few metropolitan regions are capable of performing this kind of programmatic, comprehensive strategic planning. Within these large multi-jurisdictional regions, governments and agencies have difficulty planning, building, and operating transportation infrastructure in a strategic and coordinated way. In addition, they generally have not had success at integrating transportation policy with land use, housing, economic development, and energy and environmental policies. These policy spheres are all deeply intertwined in reality, but

the ability to link them within government agencies and processes is weak or nonexistent.

Moreover, in too many places in the country the basic MPO framework, created in 1962 and substantially strengthened by ISTEA in 1991, is not meeting its promise. Where it *is* working, the federal government should look to MPOs to carry out the strategic planning that is essential to the programmatic framework described in this chapter. What is needed in many cases, however, is a process of decision-making and priority-setting at the metropolitan level that works, regardless of institutional structure. Separate transportation planning and operating agencies in metropolitan regions (particularly, multi-state ones) can only develop and carry out comprehensive strategic programs by working together.

This cooperation could be arranged by creating authoritative governing institutions or by other means, but whatever the mechanism, improved institutional collaboration is an essential prerequisite to the success of the metropolitan transportation programs NTPP has proposed. We hope that the promise of federal funds would spur metropolitan regions to make such collaboration work. Similarly, states and metropolitan areas will need to work together to make improvements to state facilities that are essential for metropolitan economies. It is not the role of the federal government to specify how this should come about—that process too must be bottom up. Nevertheless, it bears emphasizing that without addressing the need for institutional collaboration many metropolitan areas will be unable to compete effectively for ICT funds.

VISION OF LIKELY COMPETITIVE PROGRAM OUTCOMES

Though we recommend a grant application process for both the new competitive programs that is bottom-up and provides total flexibility to states and metropolitan regions to innovate around solutions, certain predictions

about the kinds of programs that are likely to be funded can be ventured based on the performance metrics we are suggesting. As a general matter, the IFC and ICT programs are very likely to fund comprehensive strategic programs that incorporate elements of the following three concepts:

- Integrated, complementary, and multi-modal capital projects
- Technologically advanced and innovative systems management and information improvements
- Administrative and financial initiatives that support transportation investments and operational improvements

Furthermore, it is difficult to imagine a new transportation program that simultaneously advances economic, energy, and environmental sustainability objectives that does not include one or more of the following specific strategies, in addition to transportation capital investments:

- Advanced vehicle and fuel deployment programs
- Congestion or value pricing¹⁴⁴
- Greater integration of land-use regulations, transportation investment, and urban form
- Enhanced systems management through information technologies

The next several sections of this chapter elaborate briefly on each of these likely strategies.

¹⁴⁴ The role of pricing and other user-based funding practices in maximizing transportation system performance and achieving sustainable outcomes is discussed in more detail in the next section of this chapter.

Advanced Vehicle and Fuel Deployment Programs

A key set of tools for reducing petroleum consumption and greenhouse gas emissions exists at the state and local level in the form of strategies to support and encourage the use of alternative energy sources and more fuel efficient vehicles. Most state and local governments are not, of course, in a position to drive the fundamental development of vehicle technologies and alternative fuels. Yet they have a potentially important role to play in providing the supportive policies and incentives needed to accelerate the deployment of more advanced vehicle technologies and fuels.

For example, clean car incentive policies, such as feebates, have received attention in multiple states and internationally.¹⁴⁵ The idea is to impose fees to discourage the purchase of vehicles that get poor mileage or are highly polluting, and use those fees to award rebates to those who buy fuel-efficient, low-emitting vehicles.¹⁴⁶ Depending on how a locality chooses to structure such a program, feebates can encourage a shift to both higher efficiency conventional vehicles and to advanced vehicles that use alternative energy sources (e.g., electric, hydrogen, and flex-fuel vehicles).

In some cases state and local transportation initiatives can link with broader federal policies in the energy and climate arena. For example, the current federal renewable fuels standard (RFS) mandates a major increase in

¹⁴⁵ Feebate legislation has been introduced nationally and in several U.S. states—including California, Maryland, Massachusetts, Rhode Island, Iowa, and Arizona. Internationally, clean car incentives are being enacted in countries including the United Kingdom, the Netherlands, Denmark, Canada, and Japan. Sources: Japan Automobile Manufacturers Association (JAMA). "The Motor Industry of Japan 2007." May 2007; Transport Canada, Budget 2007. "Eco Transport Vehicle Eligibility." 2007; Government of Ontario, Ministry of Finance. "Tax for Fuel Conservation (TFFC)." 2007; ACEA 2007.

¹⁴⁶ Gordon, Deborah and Levenson, Leo. "DRIVE+: Promoting Cleaner and More Fuel-Efficient Motor Vehicles Through a Self-Financing System of State Tax Incentives." *Journal of Policy Analysis and Management* 9, no. 3 (1990): 409–15.



the use of biofuels by 2022.¹⁴⁷ If the RFS remains as national policy (without commenting on the controversy that surrounds this issue), a growing fleet of flex-fuel vehicles (FFVs) will be needed to absorb the higher-blend alcohol fuels such as E85.¹⁴⁸ Depending on the outcome of a current debate about the true life-cycle greenhouse gas impacts of increased biofuels use, states and localities could enact policies that provide incentives for consumers to purchase FFVs and gas stations to invest in installing E85 refueling capacity. Another possible example relates to the electrification of the vehicle fleet, which—if pursued on a large scale—may require upgrades to the electricity grid and an increase in locations with battery charging capability. There is no reason why metropolitan areas cannot incorporate such upgrades as elements of their ICT proposals, and there may be potential for grant proposals that target freight corridor improvements under the IFC program to incorporate them as well.

In fact, electrification may be one of the solutions to metropolitan transportation problems that scores well on several metrics. Even where coal plays a large role in the electricity supply mix, this approach can offer overall efficiency gains, greenhouse gas reductions, and broader electric-system benefits (especially if vehicles are usually charged at off-peak times). With plug-in hybrids

on the horizon, metropolitan areas may consider providing recharging infrastructure as well as vehicle purchase incentives. However, any electrification program would also have to score well on the economic performance measures, and thus would be likely to also incorporate one of the pricing strategies described below.

Congestion or Value Pricing

Congestion pricing was the prescriptive goal of the previously described Urban Partnership Agreements program. While NTPP does not wish to prescribe specific solutions, congestion pricing is an extremely valuable tool for addressing the economic, environmental, and energy impacts of transportation simultaneously. The term congestion pricing typically refers to a policy for charging vehicles to use a certain road based on time of day and distance traveled. However, the concept can also be applied to a specific area within a city, to a specific lane on a highway, to an entire facility, or even to parking rates. The effect is similar to that of charging a price for bread instead of giving it away for free: The lines diminish greatly. Funds generated by a congestion pricing policy can then be used to support more affordable and sustainable transportation alternatives.

Whenever congestion pricing is proposed there are strong objections on the basis of equity. Many people fear that poor people will simply be priced off roads and transit systems, leaving free-flowing systems for the wealthy. Such social equity concerns are indeed important, but they ignore the social inequities of our current transportation finance system. In comparison with our current system of transportation finance, a user fee system based on the principles of marginal cost pricing (or its proxy in the form of road pricing) would **increase** equity. Research on travel behavior has shown that the use of highway systems in congested conditions is positively correlated with income. That is, higher-income travelers tend to spend a larger share of their travel time in traffic

147 From 11.10 billion gallons of biofuel in 2009 to 36 billion gallons in 2022.

148 E85 refers to a fuel blend that is 85 percent ethanol and 15 percent conventional gasoline. For more detail on the infrastructure implications of increased biofuels see the National Commission on Energy Policy's *Task Force on Biofuels Infrastructure*. 2009.

congestion than do lower-income travelers.¹⁴⁹ Thus, shifting to a transportation finance system that charges drivers more on congested routes and less elsewhere would improve equity compared to our current finance system, because higher-income drivers would be paying a greater share of the costs of transportation.¹⁵⁰

In comparison with our current system of transportation finance, a user fee system based on the principles of marginal cost pricing (or its proxy in the form of road pricing) would increase equity.

Another policy intended to more transparently charge people for how much they drive is pay-as-you-drive insurance (PAYD). The basic idea is that a portion of a driver's car insurance payment is pegged to VMT or driving patterns, creating a marginal incentive to minimize driving and rewarding those who drive less. Many insurers support this approach since reduced vehicle use generally translates into reduced collision rates. Insurance regulation is typically a state function and thus instituting PAYD insurance remains a state-level policy option that could help advance a number of national-level goals. By providing users with clearer signals about the cost of their transportation choices, pay-as-you-go

149 (1)Dittmar, Hank, Karen Frick, and David Tannehill. "Institutional and Political Challenges in Implementing Congestion Pricing: Case Study of the San Francisco Bay Area Curbing Gridlock: Peak-Period Fees to Relieve Traffic Congestion -- Special Report 242." 1994. (2) Frick, Karen T., Steve Heminger, and Hank Dittmar. "Bay Bridge Congestion-Pricing Project: Lessons Learned to Date." 1996. Transportation Research Record 1558: 29-38. (3) Sullivan, Edward. "Continuation Study to Evaluate the Impacts of the SR 91 Value-Priced Express Lanes, Final Report to Caltrans." 2000.

150 Schweitzer, Lisa and Brian D. Taylor. "Just Pricing: The Distributional Effects of Congestion Pricing and Sales Taxes," Forthcoming. Transportation. DOI 10.1007/s11116-008-9165-9.

systems such as PAYD insurance and congestion pricing can cut greenhouse gas emissions and reduce energy use because users change their behavior in response to the price they now see. PAYD can peg a portion of the insurance payment to a driver's VMT or driving patterns, rewarding those who drive less.

Greater integration of land-use regulations, transportation investment, and urban form

The nexus between land use, transportation, and urban form has always existed. Transportation investments and inventions shape urban design, and land uses often drive where and how transportation networks develop and operate. While the causal connection between economic growth and VMT remains a matter of dispute among laymen and economists alike, that the two are related is widely accepted. Certainly, mass car ownership and highway construction in the past six decades have had an enormous impact on the way urban areas have grown and have, in the words of International Monetary Fund (IMF) economists, emerged as integral components of advanced economies: "Workers can cover longer distances in their daily commutes, effectively increasing the size of the labour market and facilitating specialization in production; consumers can purchase goods from shops farther from their homes, which results in greater competition in the retail sector . . . and so on" (quoted in *The Economist*, November 15, 2008).

That trends over the last several decades have contributed to steady growth in transportation-related energy use and greenhouse gas emissions is obvious. To shift that trajectory, patterns of land planning and development, transportation investment, and energy use must be reoriented to maximize economic growth and prosperity while mitigating environmental impacts and reducing greenhouse gas emissions. Thus, it will be helpful for ICT programs to incorporate land-use regulations and related administrative initiatives across jurisdictional lines in metropolitan regions. These ac-

tions can enable progress on economic, energy, and environmental issues simultaneously.

Enhancing systems management through information technologies

The current economic crisis provides a timely real-world example of the impact of marginal changes in travel capacity and demand and their outsized effect on congestion levels. The net effect of volatile fuel prices and a deep recession was an overall drop in national vehicle miles traveled of 3–4 percent depending on the type of roadway facility. A recently completed study¹⁵¹ estimated that peak-period highway congestion dropped by

Despite the dramatic transformations wrought by IT in almost all other aspects of business and society, the United States has not yet achieved the level of technological innovation needed to address major transportation system performance challenges.

30 percent nationwide between 2007 and 2008 as the result of a 3 percent decline in urban interstate traffic volume, as reported by FHWA.¹⁵² While the macroeconomic causes of this decline in travel demand were not desirable, nor would we want them to be sustained or repeated, there is an important lesson here. When facilities are at or near capacity, even modest changes in the amount of supply and demand can have a very large impact. This suggests that policies or techniques such as traffic management, managed/High Occupancy Toll (HOT) lanes, and travel information can deliver dispro-

portionately positive benefits in terms of reducing, or slowing the rate of growth in, congestion. Reduced congestion leads to other benefits such as a reduction in secondary accidents and fatalities, and reduced fuel waste and carbon emissions from vehicle idling.

This implies that a successful IFC or ICT grant application could incorporate the systematic application of information technologies (IT) in transportation networks. The opportunities in this area are significant because, despite the importance of transport systems in daily life and economic activity, and despite the dramatic transformations wrought by IT in almost all other aspects of business and society, the United States has not yet achieved the level of technological innovation needed to address major transportation system performance challenges. In private sector enterprises, for example, IT systems are routinely employed to manage complex worldwide supply chains, but this technological revolution has not yet taken hold in transportation.

To be sure, some IT improvements have already been deployed in the transportation arena; examples include integrated corridor management programs, traffic signal synchronization and prioritization, technologies to implement congestion pricing policies, ramp metering, incident and road weather management systems, and online traveler information services. In addition, there have been initiatives to develop further IT improvements, such as the federal effort to advance “intelligent transportation systems” or ITS. While these early deployments of IT in transportation have been cost-effective, however, their impacts on overall system performance have been modest. Moreover, the level of technological innovation and change in transportation systems seems comparatively low in contrast to other industries.

Unlike earlier revolutions and innovations in transportation (such as the advent of steam engines, railroads, automobiles and highways) the transportation revolution

151 <http://scorecard.inrix.com>

152 <http://www.fhwa.dot.gov/ohim/tvtw/tvtpage.cfm>

before us in the 21st century primarily involves the application of new sensor, communication, and information technologies to existing transportation systems. These innovations offer the promise of reshaping how we use transportation facilities and networks and can play a significant role in future strategies for advancing multiple transportation-related economic and environmental goals. The fact that we have been slow to deploy these innovations is primarily attributable to institutional barriers: Simply put, we are not organized to take advantage of these kinds of technological innovations. Public-sector roles and responsibilities for planning, funding, building, operating, and regulating the transportation system must be reshaped, in order to facilitate the adoption and deployment of new technologies. The systematic

application of IT innovations in transportation systems would not only improve performance along multiple dimensions but perhaps even more importantly create a systems intelligence function to support the impartial analysis of transportation programs at the local, regional, and national levels (this subject, along with some of the institutional issues, is discussed in more detail in the final sections of this chapter).

Principles and Strategies for Funding a Performance-Based System

NTPP-sponsored research supports the proposition that how transportation revenue is raised and the extent to which system costs are transparent have direct ef-

Revenue Principles from the National Commissions

The core principles and strategies we recommend for addressing revenue challenges align closely with the conclusions reached by both the National Transportation Policy Commission and the Financing Commission. They include the following points:

- Revenue currently collected at all levels of government is insufficient to either maintain or improve system performance;
- Revenue collection methodologies should be directly linked to improving system performance;
- Public revenue collection can enhance the performance of the system when users more directly understand and bear the full costs of the infrastructure they use;
- Policy-makers should address the research, standard setting, technology, privacy protection, equity and administration issues for an improved national user-pay funding mechanism, including requiring the development of a time-phased implementation plan;
- The recent trend toward financing federal transportation investments with non-user-based, general taxpayer funds should be reversed; and,
- Distribution of federal revenues should promote both accountability and net increases in sustainable state and local revenue sources.

facts on both the performance of the system and the level of total investment needed. Our primary focus in this report has been the direction and structure of a performance-driven national surface transportation program. However, the close relationship between how

different levels of government in maintaining, operating and improving the performance of our infrastructure must become more transparent. This will crystallize the federal role in funding programs that further specific national interests.

How transportation revenue is raised and the extent to which system costs are transparent have direct effects on both the performance of the system and the level of total investment needed.

While many understand that the nation has largely been relying on our parents' and grandparents' transportation investments, proposals to increase revenues are frequently opposed as "double taxation" or resisted with complaints that users have "already paid" for the road. Bold political leadership is needed to bring the actual reality to light. Federal highway spending (and taxation) per mile travelled has actually *fallen by nearly 50 percent* since the highway trust fund was established in the late 1950s. Moreover, because the gas tax is not indexed to inflation, its purchasing power has declined by 33 percent since it was last increased in 1993. As population has grown and trade has expanded, our basic infrastructure has deteriorated. At the same time, the lack of transparent and fully user-based financing perpetuates individual and commercial decisions that do not take into account the full public costs imposed by private transportation choices.

transportation systems perform and how transportation revenues are generated means that we cannot ignore the issue of how funds are raised. Our basic conclusion in this regard is that, beyond simply addressing the need for additional revenue, policymakers should also ensure that revenue is generated in ways that promote improved system performance. NTPP therefore offers the following recommendations concerning transportation funding:

FINANCING RECOMMENDATION: INCREASED REVENUE SHOULD BE LINKED TO PERFORMANCE

Adequate and sustainable funding is an essential dimension of putting in place a true performance-based system. Obscuring the true costs of maintaining, operating and updating our transportation networks is not in the national interest.¹⁵³ As a new national program is defined, the primary roles and responsibilities of

Federal highway spending (and taxation) per mile travelled has actually fallen by nearly 50 percent since the highway trust fund was established in the late 1950s.

A wide variety of circumstances have combined to continually weaken the link between transportation funding (primarily via the gas tax) and the costs imposed and benefits received by system users. Cost-allocation studies have repeatedly revealed that large, heavy trucks pay

153 "Using Pricing to Reduce Congestion", 2009, <http://cbo.gov/doc.cfm?index=9750>

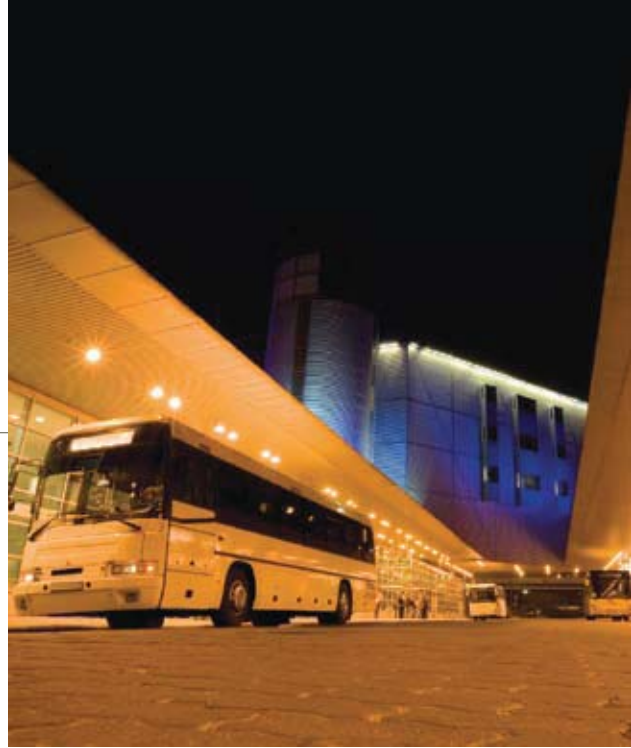
far less than the full costs they impose on the system,¹⁵⁴ which may disadvantage other freight modes. Further, the failure to “price” the many social, economic and environmental externalities of travel has contributed to unsustainable development patterns and little individual awareness of, or concern for, energy consumption, emissions, or congestion impacts.

Evidence presented in this report demonstrates that transportation investments can deliver clear, long-term economic and social benefits. But directing more resources to transportation through a set of existing policies and programs that is unsustainable, unfocused, and underperforming offers little likelihood of success. As important as spending more money is *spending money more wisely and in a more targeted way*. Comprehensive restructuring the entire array of federal transportation policies and programs, as called for in the body of this report, should be the first order of business.

FINANCING RECOMMENDATION: FAVOR DIRECT, USER-BASED FEES

Taxes and fees are currently the two primary means used to raise revenue for federal transportation infrastructure. While the gas tax generates significant revenues at low administrative cost, its reliability as a proxy for transportation-system use has decreased dramatically. In an age of increasing fuel efficiency, growing numbers of hybrid-electric vehicles, and increased use of alternative fuels, payment of the gas tax bears a diminishing relationship to actual use of the system. In contrast, where users pay directly for their infrastructure use, they receive more timely and accurate signals about the full range of costs they impose and the benefits they receive. Ideally, user fees should capture diverse elements of use including miles traveled on roadways,

¹⁵⁴ United States Department of Transportation Federal Highway Administration. “Highway Cost Allocation Study.” Aug. 1997, with an addendum added in 2000. <http://www.fhwa.dot.gov/policy/otps/costalocation.htm>



vehicle weight or number of axles, contribution to congestion, and emissions.¹⁵⁵

Raising federal transportation revenue from a more complete and accurate national system of user fees can advance a range of national interests and benefits:

- Enhancing equity across all users;
- Promoting consistency with energy and environmental goals by ensuring that transportation users bear the cost of energy and environmental impacts;
- Reducing congestion and increasing the reliability of travel times;
- Promoting more accurate user-based signals with respect to investment priorities;
- Reducing capital needs as users internalize cost impacts and rationalize their use of the system.

A strong user-pay system would free up existing resources to cross-subsidize certain areas or user groups, such as rural highways or other critical investments, for which 100 percent direct user-pay funding is not feasible. The user-pay principle should be at the core of any short-term increases in existing taxes and/or fees as well as in the development and structure of new revenue sources and mechanisms for the longer term.

¹⁵⁵ Transportation Research Board. “Fuel Tax and Alternatives, Special Report 285. 2006. www.TRB.org/publ/sr/sr285.pdf

FINANCING RECOMMENDATION: CONDUCT RESEARCH AND PLANNING TO TRANSITION TO A NATIONAL USER-PAY FUNDING MECHANISM

Transitioning to a performance-based surface transportation system that is better equipped to address 21st century challenges requires a timely and evidence-based transition to user-pay funding mechanisms. This means we should begin methodically researching, testing, evaluating and resolving the various issues that are likely to arise in the course of such a transition.¹⁵⁶

Although the structural problem with the gas tax has been widely discussed and well understood for at least a decade, tangible steps to address the problem to date in the U.S. have been in limited test areas. While these tests have been useful in proving that more direct user-based funding approaches are possible, if the goal is a full scale restructuring of the national user-based revenue system, continued incremental experimentation is not the answer. To establish a system that at the earliest possible date can become the backbone of national revenue collection, more expansive concepts must be considered, encouraged and required. Congress must be clear that continued research for its own sake is not the goal – establishing and then implementing an achievable plan that can generate the support of the American public, transition and then scale on a national basis at the earliest possible date is the goal.

Over a decade ago, the state of Oregon mandated state research and experimentation to eliminate the gas tax and move to a complete user-based fee structure. The state recently completed a pilot program demonstrating that a mileage-based, congestion-related fee could be implemented using global positioning system (GPS)

technology to count miles driven with minimal difference in process or administration for motorists compared to how they currently pay the gas tax.¹⁵⁷

A funding system based on on-board GPS units could charge differentially for mileage in high congestion zones or for travel during more congested times of day. The system could also apply different fees based on vehicle fuel economy and emissions. Such a tailored alignment of fees to distinct costs will send the proper price signals to users, thereby reducing congestion, emissions, and fuel consumption. This is important because, while there is a growing support for a “mileage-based” system – or VMT fee— such a fee will only provide accurate cost signals if it is adjusted for vehicle fuel economy. (A simple VMT fee would provide no incentives for customers to buy vehicles with higher fuel economy ratings because the fee would depend only on mileage.) Similarly, a mileage-based fee would have to account for the fact that not all miles are created equal. Mileage-based fees that vary based on congestion provide incentives for drivers to shift to off-peak periods, consolidate trips, use less congested routes, use alternative modes, or telecommute. They also can be tailored to avoid penalizing rural drivers who travel long distances on relatively empty roads. Finally, a corollary benefit of increasing the transparency of costs is that capital investment decisions will be guided by quantitative signals of increased demand for physical capacity.

Over a longer time horizon, a vehicle-based revenue system may offer additional efficiencies and dramatic new safety benefits if it is integrated with developing proposals for integrating “smart road–smart car” technologies. The platform of on-vehicle GPS technology is already being applied to advanced innovations with automatic crash prevention. Other applications are being

¹⁵⁶ National Surface Transportation Policy Study and Revenue Commission. “Transportation for Tomorrow.” 2007. Back up and technical papers: http://transportationfortomorrow.org/final_report/technical_issue_papers.aspx; See in particular papers 5A-06 re container charge; 5A-15 re PPPs; 5B-03 re financing options for freight and intermodal facilities; 5B-05 re phasing in new fees.

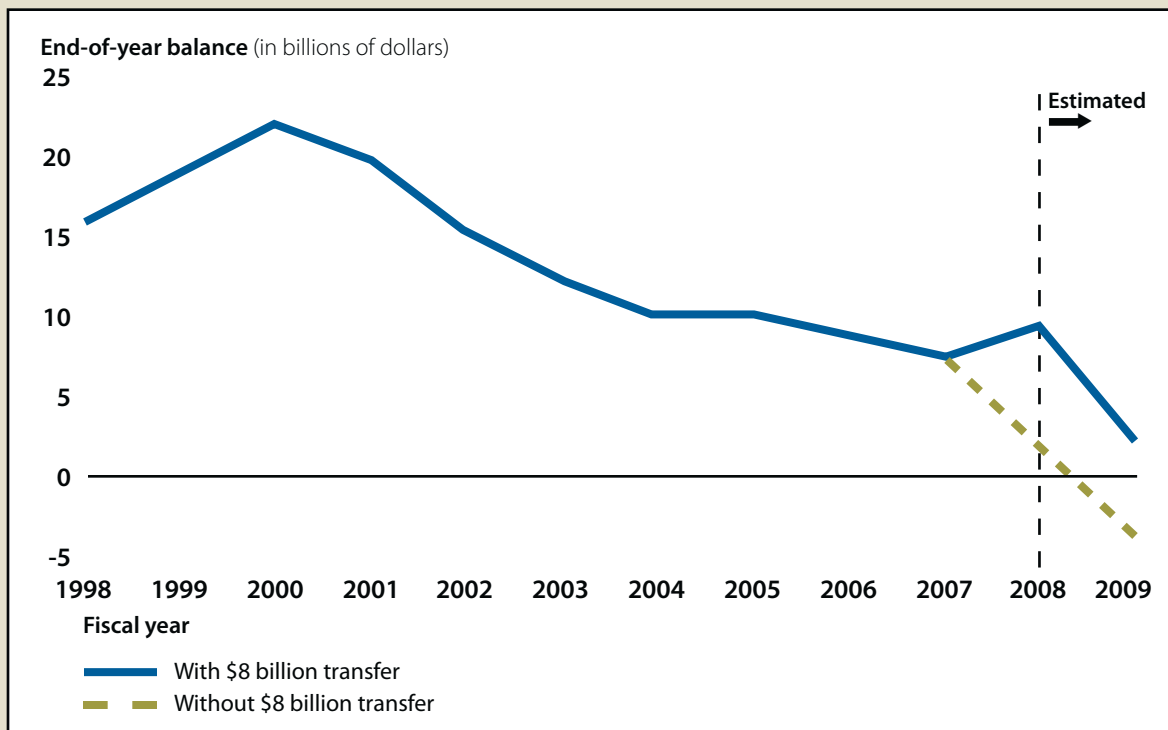
¹⁵⁷ Whitty, James M. “Oregon’s Mileage Fee Concept and Road User Fee Pilot Program: Final Report.” November 2007. Oregon Department of Transportation.

adapted to provide diverse consumer services including routing, vehicle optimization, and payment of a range of services such as parking, registration and weight or emissions-related fees.

Because a vehicle-based fee would likely be collected from individual drivers, however, the implementation of such a system presents numerous transition and operational challenges. For example, efficiently linking a nation-wide user fee system with state and local revenue collection, publicly tolled facilities, and private operators, will require that a host of issues be addressed:

- Privacy protection
- Individual and geographic equity considerations
- Appropriate cross-subsidies
- Mechanisms to internalize environmental and energy security externalities
- Administrative methods and costs
- Interface with states, localities, public facilities (e.g. toll bridges) and private operators

Figure 12: Highway Account Balance, Fiscal Years 1998 through 2009



Source: Government Accountability Office. "Transportation Programs, Challenges Facing the Department of Transportation and Congress, Statement of Katherine Siggerud." Mar 10, 2009. GAO-09-435T.

Stimulus Funds for Infrastructure are Not a Substitute for Sustainable Infrastructure Policy

The American Recovery and Reinvestment Act (ARRA) of 2009 was enacted in response to what is generally characterized as the nation's worst economic crisis since the Great Depression. As part of this package, U.S. DOT received about \$48 billion for investments in transportation infrastructure—primarily for highways, passenger rail, and transit—and mostly for use through fiscal year 2010. While described as the greatest public investment in infrastructure since the initiation of the Interstate Highway System, the Financing Commission has noted that stimulus funds will cover only about three months of the identified *annual* gap in funds to maintain and improve the nation's transportation system. More importantly, the funds are layered onto an untargeted and unaccountable system that lacks both a strategic approach to investment choices and a comprehensive set of performance-based programs. The stimulus should be recognized as primarily designed to achieve the immediate objective of stimulating demand and creating jobs—not as a sound foundation for a thoughtful 21st century national transportation policy.

- Accounting and distribution of revenue
- Technical research and development
- Technology standards and deployment

In the next surface transportation authorization bill, Congress should direct the U.S. DOT to begin the research and testing necessary to support development of an improved user-based funding system. This research should also develop a plan for how to transition to such a system before the expiration of the authorizing legislation.

IMMEDIATE ISSUES IN MOVING TOWARDS USER-PAY FINANCING MECHANISMS

While research and development efforts can help advance progress toward a user-based funding system,

several critical interim policy principles should be applied in the near term:

- Set a high bar for use of any general funds for transportation
- Minimize moves away from user financing
- Be transparent in establishing new financing mechanisms
- Fund a new focus on freight with a mode-neutral freight fee
- Help states and local governments develop sustainable funding sources
- Charge transportation users the costs of their carbon emissions and use those funds on transportation

***(Near-Term) Financing Recommendation:
Set a high bar for any use of general funds
for transportation***

There are at least two compelling reasons to set a very high bar for any use of general funds for transportation. The first and most obvious is that every dollar of additional spending out of general funds at this time represents additional borrowing and thus exacerbates the already extreme deficit problems and fiscal challenges the nation will confront in the coming years. Second, even before it is feasible to transition fully to a user-pay system, numerous opportunities exist to raise revenue for near-term transportation needs in ways that help make system costs more transparent, send more accurate price signals to users, and thus promote more efficient use of the system. For example, technological advances already in use in many other countries and in some areas of the United States now enable efficient and reliable systems for collecting system fees and road tolls. Road tolls, in particular, offer the added benefit that either public or private entities can bond against the projected revenue stream—thus providing an up-front source of capital to improve or expand existing networks. By contrast, simply relying on general funds further obscures the true cost of the transportation system to users and does nothing either to promote efficient use of the system or to advance critical societal objectives with respect to energy, the environment, and reduced congestion.

***(Near-Term) Financing Recommendation:
Minimize departures from user financing***

Until a new and long-term sustainable revenue mechanism in the form of a user-based fee can be implemented, short-term revenue-enhancing measures are likely to be put forward to cover the costs of increased federal support for transportation—or even to maintain the levels set in SAFETEA-LU.

The immediate pressures on the Highway Trust Fund (HTF) are stark and compelling. Even with the infusion

in 2008 of \$8 billion from the General Fund, highway account receipts continue to be lower than had been estimated—first as a result of high oil prices in the early part of 2008 and later as a result of the current economic downturn, both of which have put downward pressure on VMT, fuel purchases, and revenues flowing to the HTF. The account will reach a critical stage again

Creation of a new special-purpose financing entity does not necessarily address any of the fundamental performance challenges that confront our transportation programs and that have been explored at length in this report.

before the end of fiscal year 2009, requiring either a dramatic reduction in recent spending levels or another infusion of revenue from other accounts, or a combination of the two.

NTPP recommends that any action by Congress to generate additional revenue for transportation should:

- Advance the user-pay principle. For example, fees could be updated to reflect losses in purchasing power or to be better aligned with the costs imposed by different users.
- Be targeted to reward performance as recommended in NTPP's proposed performance bonus program for system preservation investments, or our proposed competitive programs for system expansion investments.

***(Near-Term) Financing Recommendation:
Be transparent in establishing new financing
mechanisms***

Issuing new federal bonds or establishing and capitalizing a national infrastructure bank both need to be recognized as forms of borrowing. The use of general taxpayer funds should be limited to programs which demonstrably generate nationally significant and broadly based public benefits. Creation of a new special-purpose financing entity does not necessarily address any of the fundamental performance challenges that confront our transportation programs and that have been explored at length in this report. Consistent with our overall recommendations, the operations of any new financing entity need to be clear, specific, and transparent regarding actual revenue sources and beneficiaries. Such an entity should also apply rigorous quantitative performance metrics covering the range of national interests that need to be balanced, and strive to align funding sources with the beneficiaries of federal investments. Finally, establishing a new financing entity must not be seen as a substitute for moving aggressively to develop sustainable and adequate sources of revenue for transportation infrastructure that are supported—to the maximum extent possible—by well-designed user-based fees.

***(Near-Term) Financing Recommendation:
Implement a mode-neutral freight fee***

As discussed elsewhere in this report, a well-targeted program to address critical freight bottlenecks and improve transport efficiency along critical freight corridors, networks, or connectors is vital. The soundest basis for infrastructure investments that improve the performance of the entirely private existing freight system is a new user-based freight fee. The fee structure should reflect the range of the freight network and the burden each mode imposes on public infrastructure, as well as the relative fuel efficiency and/or greenhouse gas emissions of different modes of freight transport. Revenues

from the fee should be applied to projects that have clear benefits for freight transport.

***(Near-Term) Financing Recommendation:
Charge transportation users the costs of their
carbon emissions and recycle those funds
into transportation***

As we have noted at different points, the transportation sector contributes nearly one third of U.S. greenhouse gas emissions, and therefore needs to play a major role in policies to reduce climate risks. Effective pricing of transportation-related carbon emissions is needed to complement other transportation-related policies on energy and the environment, such as fuel efficiency standards and alternative fuels programs. It is likely that any greenhouse gas cap-and-trade system or carbon tax adopted in the United States over the next few years would have at most an initially modest impact on the price of a gallon of gas. Further analysis is needed to ensure that the right incentives are in place to motivate transportation users to reduce carbon emissions. This is particularly urgent since the evidence shows that transportation as a sector has been one of the fastest growing contributors to overall carbon emissions. Concern about a lack of incentives for reducing emissions is one reason that some observers caution against a premature commitment to plan for the full substitution of the gas tax with user-based fees; while gas taxes may not be an adequate proxy for road use, they are an appropriate proxy for pricing carbon emissions and energy security externalities.

Just as transportation needs to bear an appropriate share of the abatement burden associated with controlling and reducing greenhouse gas emissions at a national level, so an appropriate share of revenues from a new carbon pricing scheme should go toward the support of transportation infrastructure investments and operational reforms that produce direct carbon reduction benefits.

(Near-Term) Financing Recommendation: Help states and local governments develop sustainable funding sources

While NTPP supports a well defined federal focus on nationally significant infrastructure, there is also a national interest in supporting and incentivizing state and local governments to develop sustainable funding sources for locally significant infrastructure investments. Historically there has been some evidence that states have reduced their own funding as federal transportation grants increased. While states' revenue sources vary, the real value of the average state gas tax has declined by more than 30 percent since the late 1950s. It is clear that achieving national performance goals for our entire transportation system will require that states and local governments have an ability to substantially increase revenues for needed infrastructure investments.

Accordingly, the federal government should facilitate state and local capacity to develop sustainable, equitable, and performance-enhancing revenue streams. States and localities have a wide range of transportation investment and revenue-raising options at their disposal, including private partnerships, fuel and/or dedicated sales taxes, congestion pricing, developer fees, toll roads, HOV conversion to HOT lanes, and value capture from transit development. While the federal government should not be in the business of prescribing specific state and local strategies¹⁵⁸, it can remove impediments and support efforts to use creative financing tools at the state and local level.¹⁵⁹ Three concrete steps the federal government can take in this regard include:

158 Government Accountability Office. "Highway Public-Private Partnerships: More Rigorous Up-Front Analysis Could Better Secure Potential Benefits and Protect the Public Interest." Sep. 2008. GAO-08-1149R.

159 Government Accountability Office. "Highway Finance: States' Expanding Use of Tolling Illustrates Diverse Challenges and Strategies." June 2006. GAO-06-554.



Policy Recommendation: Reduce restrictions on road pricing.

Performance and environmental goals are likely to be most cost-effectively achieved with the greater use of variable pricing on congested roadways. The federal government should remove remaining restrictions to instituting such policies on the nation's roadways, albeit with appropriate controls and oversight measures.

Policy Recommendation: Support efforts by states to implement direct user charges.

Direct user fees, such as a mileage-based charge, can improve system performance and represent a critical tool for states and metropolitan areas to supplement or eventually replacing traditional revenue sources. Support should be provided to states or groups of states piloting new comprehensive user-based fees. This includes developing specific strategies for garnering public support and confidence in privacy protections for users, as well as developing an efficient and reliable administrative pricing and payment mechanism.

Policy Recommendation: Expand TIFIA credit support.

With the removal of restrictions on pricing, the TIFIA program should be expanded to allow for loans that are paid back with variable pricing tolls on national highways. TIFIA should also adopt the performance metrics we have proposed to aid in their assessment of projects.

Institutional Reforms: The Federal Interest in Governance, Planning, Data, and Research

It is difficult to imagine that an entirely new and dramatically re-oriented programmatic framework for transportation investments can be established in the absence of significant institutional reform at all levels of government. To realize the benefits of policy and technology innovations in transportation there must be parallel institutional innovations. Public sector roles and responsibilities must be reshaped and reorganized for effectively planning, funding, building, operating, and regulating the nation's transportation system.¹⁶⁰

While there clearly will be some expansion of transportation capacity in the United States in the near term, most of our attention and investment now needs to be focused on rebuilding, reshaping, and modernizing existing facilities to serve America's changing trade, economic, community, energy, and environmental needs.¹⁶¹ At their core, the key decisions that will need to be made must center on how we can better use and enhance the performance of the nation's transportation systems.

Policy Recommendation: Reorganize U.S. DOT around National Goals

At the federal level, transportation policies and programs play a key role in meeting national economic, energy, environmental, and social goals. The U.S. DOT should be reorganized and more closely linked with other federal agencies to reflect these interests and

values. In addition, the organizational structure of DOT should reflect the reorientation of transportation programs around broader national goals. Strategic investments, mode neutrality, performance measures, and accountability are values that have been largely absent from past federal transportation programs. Some lessons may be drawn from the experience of the Department for Transport (DfT) of the United King-

The organizational structure of DOT should reflect the reorientation of transportation programs around broader national goals.

dom. Following the filing of the Eddington Report, DfT undertook to reorganize itself around the sustainability goals that the report had recommended. Specifically, DfT moved away from the same sort of modal organization that currently characterizes the U.S. DOT (and that reflects the jurisdictions of Congressional committees) toward an emphasis on national objectives and places, in order to improve vertical and cross-modal integration. DfT is now organized by national, city and regional, and international networks, and around programmatic functions such as environmental stewardship and climate change. Modal operations and planning services are organized within this overarching network principle.

NTPP recommends organizing the U.S. DOT around national goals. A good first step towards this end would be to establish modal coordinating mechanisms within the Office of the Secretary. This would imply an organizational focus on national connectivity (both passenger and freight movement), metropolitan acces-

¹⁶⁰ Based on a memorandum to NTPP by Lance Grenzeback, January 2009.

¹⁶¹ 1) Transportation Research Board's National Cooperative Highway Research Program. "Guidebook for Integrating Freight into Transportation Planning and Project Selection Processes." 2007. Report 594. 2) "Rail Freight Solutions to Roadway Congestion- Final Report and Guidebook." 2007. NCHRP Report 586.

sibility, energy security and environmental protection, and safety.¹⁶²

Reorganizing U.S. DOT is necessary, but not sufficient, for implementing real reform—we must also improve inter-agency coordination at the federal level. Federal energy, environmental, and housing policies and investment decisions have significant impacts on the transportation sector—just as transportation investments and policies have had consequences (albeit often unintended ones) on energy use, environmental impacts and housing patterns. A new standing interagency coordinating committee could play a valuable role in helping to ensure that the policies and priorities of different agencies support one another. Interagency coordination could also identify areas where seemingly minor legislative or regulatory changes could have major cross-beneficial impacts. Coordination at the broad programmatic level could also serve as a model for interagency cooperation on individual project financing and permitting activities, thereby addressing a common complaint about the process for issuing Environmental Impact Statements under the National Environmental Policy Act, without undermining the Act’s intent.

In fact, the Obama Administration in March 2009 announced a new partnership between the U.S. Department of Housing and Urban Development (HUD) and the U.S. DOT. The announced goal of integrating regional housing, transportation, and land-use planning and investment through this partnership is a worthy one, and the NTPP urges the Administration to build on this initiative by expanding it to include other agencies, including the Department of Energy and the Environmental Protection Agency.

162 This report has emphasized the critical linkages between transportation policy, energy security, and climate change. DOT has important research and regulatory roles in connection with these national goals. These roles should take on greater importance within DOT, which should be viewed as a lead federal agency in addressing such issues as fuel and vehicle efficiency, the development and construction of distribution infrastructure for alternative fuels, and the enhancement of system operations management.

Policy Recommendation: Provide Additional Planning Funds Contingent on Collaboration

Policy Recommendation: Enforce the Federal Planning Certification Process

With a few exceptions, the transportation planning processes that currently exist at the state and metropolitan levels do not support a strategic, performance-based, and accountable approach to decision-making. These planning processes must be reformed. The reach of metropolitan planning agencies should be extended to incorporate relevant economic geographies, and the responsibilities of planning agencies should be broadened to ensure that (a) transportation planning is conducted collaboratively across jurisdictional lines, (b) planning for the preservation of existing systems is coordinated with their expansion and improvement, and (c) planning decisions are linked to the achievement of national goals. Similarly, the planning that occurs in state transportation agencies must reach across jurisdictional lines so that strategic, performance-based plans and programs can be developed to serve multi-state corridors and/or multi-state metropolitan regions. For example, states and metropolitan areas will need to work together on improving the performance of the interstate highway system within cities in order to be effective in procuring performance bonus program funds under the new program structure NTPP has proposed.

NTPP proposes two structural changes to enhance inter-jurisdictional planning. These two changes must be implemented in concert to have a substantial impact. First, NTPP recommends making a portion of additional planning funds, contingent upon greater collaboration across jurisdictional lines. Note that under NTPP’s proposal, planning funds would be covered by a set-aside within the larger allocation of federal transportation funds to states and metropolitan areas, as is the case under the current program structure. Second, NTPP recommends enforcing the federal planning certification

process and making eligibility for all federal planning funds contingent upon this certification.

To the extent that current federal financial support for transportation planning is not sufficient or flexible enough to support broader planning efforts by state agencies or MPOs, it should be expanded. States and MPOs should be able to apply for additional funding by simply demonstrating their collaboration across useful economic units. Where existing state planning and/or MPO structures do not fit the realities of multi-state corridors, or of specific metropolitan regions, and cannot be restructured to do so, multi-jurisdictional agreements (perhaps led and enforced by state governors) can play a role setting up a strategic planning process. The goal is to establish a planning process that engages, and gets commitments from, all relevant agencies and units of government, including state agencies. In addition, this planning process should be used to develop strategic performance-based transportation plans and programs that advance the national goals identified in this report.

Conversely, eligibility for federal transportation planning funds should be conditioned on the ability of state and metropolitan agencies to carry out their responsibilities and demonstrate that they can meet objective performance criteria. While good performance by transportation planning agencies at the state and metropolitan levels should be rewarded with continuing, and in some cases enhanced, federal support, the consequences of failing to meet the appropriate standards should be recognized through the enforcement of federal certification processes that are already established by law.

The focus by government at all levels should be on adequate planning processes, rather than on particular planning structures. No single structure would fit all multi-state or metropolitan regions in any case. By adequate planning processes we mean processes that support and promote strategic planning across modes,

agencies and jurisdictions, and that link transportation planning and investment decisions to other key policy concerns such as land use, housing, energy, and environmental impacts.

IMPROVING DATA QUALITY

If available resources have not always been used effectively in the planning arena, in the data arena available resources are clearly inadequate. The use of quantitative metrics to evaluate performance and enforce accountability depends upon the availability of reliable “real-time” data. Generally, real-time, actionable data does not exist in the surface transportation sector. Alternatively, if the information is collected it is not processed, analyzed, or distributed in ways that inform decision-making or improve system performance.

The success of the reform agenda we have proposed depends on data improvements across the board, which in turn necessitates a continuous, iterative process of improvement as we move towards a system that increasingly performance-based. The criteria we recommend to distribute funds under our proposed formula programs, for example, include data from the U.S. DOT Conditions and Performance Report. This report, though generally accepted as the best current measure of U.S. road conditions, depends on highly flawed data from the Highway Performance Management System (HPMS). At a minimum, these data sources will need to be refined and overhauled.

However, the problem goes beyond any specific data set or sources. The Bureau of Transportation Statistics (BTS) within U.S. DOT has lacked a clearly articulated mission, a focused and unified purpose, a stable professional leadership, and adequately flexible resources since its establishment. All the powers and responsibilities needed to make good data available are already present in the original BTS authorizing legislation (which was modeled after the statutory framework for the U.S. Department of Labor’s

Bureau of Labor Statistics). BTS should have the capacity to make forecasts, to analyze the costs and benefits of system investments and operations, and to measure and rank performance, but little of this has occurred. NTPP proposes three reforms that can be accomplished through a new and improved BTS.

Policy Recommendation: Refocus the mission of the Bureau of Transportation Statistics

Improving data collection and interpretation requires a partnership of local, regional, state, and national transportation and transportation planning agencies. U.S. DOT must assure funding to support these efforts, and the BTS should assure the reliance and integrity of the data. BTS's position in DOT should allow it to offer independent advice and guidance about statistical methods both within and outside the Department, and to assure the integrity of this information. BTS should focus on the collection, analysis, and dissemination of information directly related to system performance. Finally, the Director of BTS should be required to make regular reports to Congress and the public.

Policy Recommendation: Acquire relevant data

BTS should acquire information and data, whether from the private or public sectors. Often the most comprehensive information on the utilization and operation of the nation's transportation system is collected by private firms. BTS can contract for data to develop, monitor, and report on system performance, and to revise and refine performance metrics. Within the limits of its legal authority, BTS should take necessary steps to assure the availability and utilization of all relevant data on system operations and performance, and on freight and goods movements, while assuring appropriate legal protections for sensitive information.

Policy Recommendation: Make better use of information technology

Information technology (IT) can be used to develop the

data needed to calculate and apply performance metrics aimed at advancing national transportation goals. Throughout the private sector, IT systems have been used to develop enterprise architectures that measure performance. Doing the same in transportation is technologically feasible and would have a transformative impact on the performance of transportation systems in the future.

RESEARCH NEEDS

The sponsorship, management and conduct of transportation-related research have long been important functions of the U.S. DOT. Critical advances in materials, structural engineering, travel forecasting, and intelligent transportation systems have historically flowed from research investments authorized by Congress and sponsored by the Department. A network of university transportation research centers owes its existence to federal funding; this network continually generates new research results while training and graduating the next generation of transportation experts and managers.

Despite its long history of excellence and leadership, federally funded transportation research today falls far short of estimated needs. Research was underfunded in SAFETEA-LU relative to then widely cited estimates of need. Under that bill, for example, only 0.9 percent of the total revenue allocated to highway agencies was directed to highway research and related technology development. By comparison, American industry on average devotes more than 3.3 percent of revenues from sales to research and development.¹⁶³ Research funding in the last two highway reauthorization bills did not address all of what Congress itself identified as high priority areas for research investment, and roughly one-fifth of all transportation research funding was earmarked. Indeed, several federal research programs

¹⁶³ Transportation Research Board Research and Technology Coordinating Committee. "The Federal Investment in Highway Research: 2006-2009, Special Report 295." 2008.



were entirely earmarked and some were even “over-earmarked” in the sense that Congress called for specific expenditures that exceeded the total funds budgeted for these programs.¹⁶⁴ Earmarking is especially harmful in research programs, since it often deprives highly qualified researchers of resources and flexibility to pursue the opportunities they think are most promising, while funding organizations that are often newer to research and therefore less productive.

Policy Recommendation: Target Research to Support National Purposes

In the next transportation bill, Congress should plan strategically for federal transportation research investments that support defined national purposes by increasing understanding of critical issues, advancing technology, and disseminating and deploying the results of federally funded research. Congress should support fundamental research efforts that have the potential to provide long-term benefits, even if there are risks that some research efforts ultimately will not produce useful results. Federal research funds should be awarded on the basis of open competition and merit-based review by qualified peers.

A renewed federal commitment and focus in this area is critical because a serious need for research exists with respect to all of the most important themes of this report. For example, research is needed to advance the goal of reducing traffic-related deaths and injuries and to better link transportation system investments to outcomes in terms of energy consumption and greenhouse gas emissions. A much stronger emphasis on

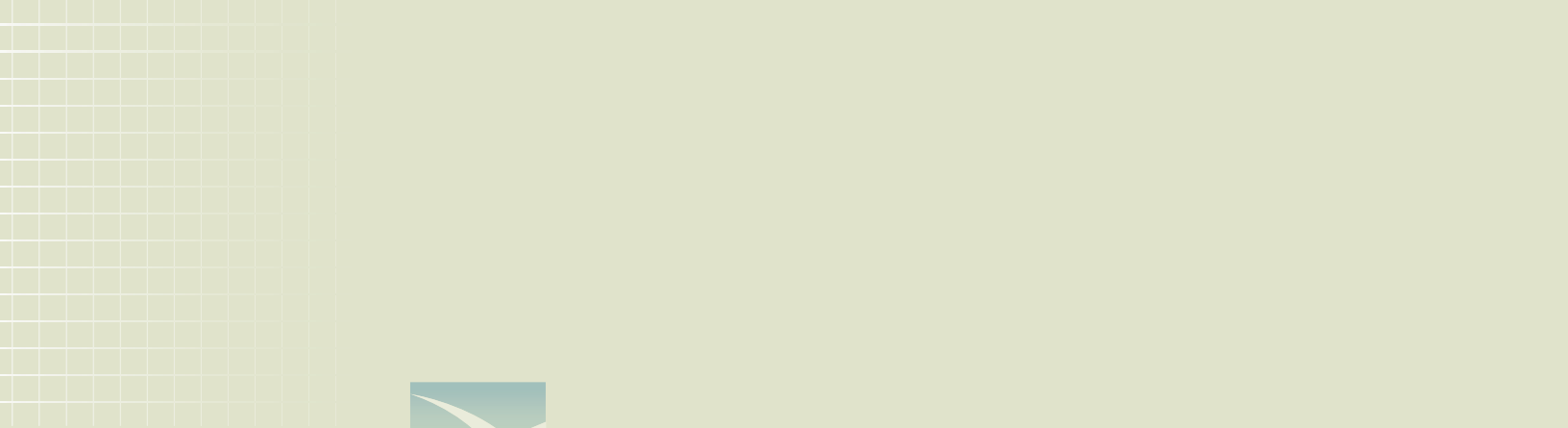
accountability and performance measurement must be supported by research investments aimed at refining performance measures and metrics. A concurrent need is for the funding of in-depth research that evaluates the effectiveness, efficiency and equity of federal programs policies and expenditures. Without an improved understanding of these issues, it will be extremely challenging if not impossible to successfully transition to a system where federal investments in transportation are held fully accountable for subsequent performance.

Closing Words: A Call to Action

Our nation faces imposing challenges to our economic, energy, and environmental future. Transportation cannot solve all of these problems – but none of these problems can be solved without transportation. In that spirit, this report is intended to provide a bold vision for the future of federal transportation policy. We have come together as a group to call for a clean sweep of reform that completely reorganizes federal policy around specific national goals and performance measures. We believe that the research, discussions, and writing we have undertaken provide a strong statement by a diverse group about the need for fundamental reform that moves us to a performance-based system.

We hope that Congress and the Administration will draw heavily upon our work when they seek to reform transportation policy. But we also know that real reform cannot occur without strong stands by all interested parties, and a groundswell of support from the nation. In the past transportation policy has been pushed through Congress by finding enough funding to satisfy everyone – but comprehensive reform will only be possible if people are willing to compromise on their own specific needs for the good of the country. At its core this report calls for a national purpose to supplant narrow individual purposes in transportation policy. It is our sincere belief that Americans will demand nothing less.

¹⁶⁴ Brach, Ann and Martin Wachs. “Earmarking in US Department of Transportation Research Programs.” *Transportation Research A*, Volume 39, No. 6 (July 2005), pp. 501-521.





Appendices

Appendix A: Other Environmental Measurements

The environmental impacts of transportation extend beyond greenhouse gas emissions. Environmental quality is important not only for the inherent value associated with having a clean and healthy environment, but also for human health and welfare, particularly when considering air quality and water quality issues. Nationally, Congress has expressed the importance of environmental quality, and environmental considerations in transportation, through protections in laws such as the National Environmental Policy Act (NEPA), the Clean Air Act (and amendments), the Clean Water Act, the Safe Drinking Water Act, the Endangered Species Act, and others. Transportation laws and regulation, including SAFETEA-LU, also require environmental considerations in transportation plans.

While we argue that the most *national* environmental concern is greenhouse gas emissions, we recognize that there is a history of federal interest in other environmental impacts, even if those impacts are primarily or only felt at a state or local level. To that end, we present here a brief discussion of various possible performance measurements for tracking air quality and other issues including water quality, habitat/ecosystems, wetlands, and community impacts.

AIR QUALITY METRICS

Air quality is an important consideration for public health, and Congress has recognized the need to ensure

that transportation plans, programs, and projects are consistent with meeting regional air quality goals. Specifically, the Transportation Conformity provisions of the Clean Air Act require that transportation plans, programs, and projects do not create new violations of the national ambient air quality standards (NAAQS), increase the frequency or severity of NAAQS violations, or delay timely attainment of the NAAQS.¹⁶⁵ Since 1991, the federal Congestion Mitigation and Air Quality Improvement (CMAQ) Program has been a key funding source for transportation projects that are designed to improve air quality.¹⁶⁶

A challenge in developing a national performance metric related to air quality improvement for purposes of distributing transportation funding is the wide diversity of air quality problems experienced in different parts of the country. There are several different air quality concerns that are affected by transportation sources, including ozone (O₃), particulate matter under 10 microns in diameter (referred to as PM-10), particulate matter under 2.5 microns in diameter (referred to as PM-2.5, or fine particulate matter), and carbon monoxide (CO). Complicating the picture is that ozone is not directly emitted by motor vehicles, but is formed by the combination of “precursor emissions”, oxides of nitrogen (NOx) and volatile organic

¹⁶⁵ The Clean Air Act requirements are found at 42 USC 740-7671. The Conformity Rule is 40 CFR 93.

¹⁶⁶ CMAQ was created by the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, and reauthorized under the Transportation Equity Act for the 21st Century (TEA-21) in 1997, and again as part of the Safe, Accountable, Flexible, Efficient, Transportation Equity Act: A Legacy for Users (SAFETEA-LU) in 2005.

compounds (VOCs), from vehicles and other sources, with sunlight. Particulate matter comes directly from motor vehicle exhaust, but is also emitted by other sources, and may be formed in the atmosphere by the transformation of gaseous emissions (i.e., secondary formation).

Potential Performance Metrics

Several potential metrics for air quality considerations are possible:

- **VMT reduced** – VMT reduction could serve as an indicator of air quality improvement, just as with energy security and greenhouse gas emissions.
- **Level of emissions reduced (e.g., kg/day, tons/year)** for carbon monoxide (CO), ozone precursors – oxides of nitrogen (NOx) and volatile organic compounds (VOCs) – and particulate matter (PM2.5 and PM10).
- **Weighted level of emissions reduced** – Recognizing that it may be valuable to have one performance metric related to air quality, rather than individual metrics for each pollutant, a procedure could be developed to sum or weight the various pollutants, so that there is one overarching metric for comparison purposes.
- **Contribution toward meeting regional air quality objectives** – Rather than developing specific measures of travel or emissions reduced as the performance metric, an alternative approach would be to examine whether or not the package of transportation strategies/projects being proposed for funding contributes toward attaining or maintaining the national air quality standard of concern to the area proposing the project.

In the context of a performance-based measures where CO₂ emissions are the primary indicator of environmental impact of transportation (as NTPP is

recommending), if an additional air quality indicator is to be added, contribution towards regional air quality objectives is probably the best of these indicators. The strengths and weaknesses of this indicator and of the second best alternative, a weighted level of emissions reduced, are described, below.

Weighted Level of Emissions Reduced / Composite Air Quality Score

Strengths. One additional challenge with using reductions in individual pollutant emissions as described above is that this measure actually involves five individual performance metrics: reductions in CO, VOC, NOx, PM10, and PM2.5. While each is an output of the MOBILE model, and can generally be calculated together easily, the challenge occurs in using these multiple metrics together. One solution to this problem is to develop a composite metric of total emissions reductions, or an “air quality score”.

There are many ways to develop a composite figure of emissions reductions, and such an approach offers multiple benefits. This composite emissions benefit figure does not have to be simply a summation of the reductions for each pollutant. Rather, the composite figure could assign weights to each pollutant, which in turn, would help to address the importance of the pollutant from the perspective of health implications, or a formula could be developed that accounts for non-attainment status or population in the region. Weighting is necessary because quantities of CO are generally about an order of magnitude higher than VOC or NOx, and so if all pollutant emissions were summed, CO reductions would dominate the metric. Similarly, a per mile basis, mass emissions of PM are roughly one-tenth the level of NOx and VOC emissions, so adding the pollutants without weighting will tend to undervalue strategies focused on PM emissions (such as certain diesel retrofit projects). Given the importance of reducing PM emissions to achieve air quality standards in many regions of the U.S.,

some weighting of PM emissions is likely warranted if a composite cost-effectiveness figure is developed.

For instance, in the 2002 Transportation Research Board (TRB) study evaluating the effectiveness of the CMAQ program, the panel considered several different weighting approaches.¹⁶⁷ In presenting the base case results, the pollutants were weighted as follows—VOCs (1) + NOx (4)—on the basis of a damage-value method, which assigns a weight to each pollutant depending on the estimated damage it inflicts on affected populations. Thus, NOx emissions reductions were weighted four times as great as VOC reductions, in part, recognizing the role of NOx as a precursor of fine particulate matter. Direct PM emissions reductions were not included in this analysis, given that at the time of the study, PM-2.5 was not regulated, and its levels were not estimated in emissions analysis studies of CMAQ projects. CO also was not included, recognizing the limited number of remaining CO non-attainment areas.

PM is generally regarded as the pollutant with the most harmful health consequences, even more damaging than ozone. The California Air Resources Board (ARB) uses a weighting factor of 20 for PM emissions when calculating cost effectiveness of projects under the Carl Moyer Program, a grant program that provides funding for clean engines and equipment. For NOx and ROG (reactive organic gases, or VOCs) emission reductions, a weighting factor of one is used.¹⁶⁸

167 Transportation Research Board. "Special Report 264: The CMAQ Program: Assessing 10 Years of Experience." 2002.

168 Historically, the Air Resources Board (ARB) has treated NOx and ROG emissions equally. For example, the cost-effectiveness of ARB's regulations is generally provided in dollars per ton of NOx + ROG, with no weighting factors. ARB staff also evaluated the relative health benefits of reducing NOx emissions and reducing PM10 emissions, estimating the monetary benefits associated with a reduction in premature deaths, asthma related emergency room visits, work loss days, and minor restricted activity days. Based on this evaluation, the health benefits of reducing one ton of PM10 outweighed the health benefits of reducing one ton of NOx by about 30 times. ARB settled on a weighting factor of 20 for PM10. Reference: California Air Resources Board. "The Carl Moyer Program Guidelines." Approved Revision 2005, Released January 6, 2006. Page I-5.

In addition to accounting for health effects, a weighting method for conducting comparisons of emissions benefits for purposes of distributing funding nationally could also take into account other factors, such as severity of the air quality problem, and population. In fact, federal CMAQ funds are currently apportioned annually to each state according to the severity of the air quality problem and the population of each nonattainment or maintenance county (based upon Census Bureau data).¹⁶⁹ Table 5 below show the weighting factors that are multiplied by population of the nonattainment or maintenance area for ozone and/or CO in the apportionment formula.

The weighting factors used for CMAQ apportionment, along with a weighting for population, could be applied to a composite air pollution reduction figure to develop an overall "air quality score" for purposes of distributing funding. It should be noted that the current CMAQ apportionment formula does not take into account PM-10 or PM-2.5 nonattainment status. Any new composite air quality score should account for PM, recognizing the importance of this from a health perspective.

The key strength of an "air quality score" is that it can account for multiple considerations of importance, and allow one figure for rating and ranking project proposals as part of an overall performance-based funding approach.

Weaknesses. The primary limitation of a composite air quality score is the potential complexity of scoring. If the score accounts for weighted emissions reductions, population, and severity of the air quality problem being addressed, as well as factors such as the duration of air quality benefits (e.g., short-term or long-term reductions), then the calculation procedures could add considerably complexity for those seeking to implement projects and programs with air quality benefits.

169 23 USC 149(b)-(c).

Table 3: SAFETEA-LU CMAQ Apportionment Weighting Factors

Pollutant	Classification At The Time Of Annual Apportionment	Weighting Factor
Ozone (O ₃) or (CO)	Maintenance (these areas had to be previously eligible as nonattainment areas - See Section VI)	1.0
Ozone	Subpart 1 ("Basic")	1.0
Ozone	Marginal	1.0
Ozone	Moderate	1.1
Ozone	Serious	1.2
Ozone	Severe	1.3
Ozone	Extreme	1.4
CO	Nonattainment	1.0
Ozone and CO	Ozone nonattainment or maintenance and CO nonattainment or maintenance	1.2 x O ₃ factor

Another challenge is the lack of standardized approaches for analyzing the emissions effects of many strategies, particularly strategies that involve transportation pricing, outreach and marketing, and travel demand management elements. This is a general weakness of any emissions analysis (not specific to a composite emissions figure), but is worth noting here as a limitation. For instance, within the CMAQ program, although most project analyses involved a quantitative assessment, many projects only listed a qualitative assessment of emissions benefits.¹⁷⁰ Perhaps more troubling from the perspective of conducting analyses for funding decisions is that the assumptions and methodological rigor of the quantitative analyses varies

170 See Federal Highway Administration's CMAQ Database. Available at: <http://www.fhwa.dot.gov/environment/cmaqpgs/index.htm>

considerably.¹⁷¹ Under a competitive program for receiving grant funding, the methodologies and assumptions used by states, MPOs, and other for the analysis would need to be reviewed for consistency, and standardized or minimum standards for analysis would likely be required. This, in turn, might inadvertently serve to discourage innovative proposals if standardized assessment procedures have not been established.

171 State and local transportation and air quality agencies may conduct CMAQ-project air quality analyses with different approaches; FHWA does not specify the emissions reduction methodologies to be used. However, FHWA stipulates that every effort should be taken to ensure that determinations of air quality benefits are credible and based on a reproducible and logical analytical procedure for inclusion in FHWA's national CMAQ database. See FHWA Memorandum, October 31, 2006. "Guidance on the Congestion Mitigation and Air Quality Improvement Program Under the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users." Page 25.

Contribution toward Meeting Regional Air Quality Objectives

Strengths. The last metric under consideration for air quality is to simply conduct an analysis for each project/program proposal to determine whether or not the project or program helps contribute toward attaining or maintaining the NAAQS of concern in the specific area where the project is being proposed. The metric is simply a “yes” or “no” response, or could involve a tiered rating structure, based on an emissions analysis for the proposed project or program (e.g., “high benefit”, “low benefit”, “neutral”, “adverse effect”). There are several benefits to this approach.

First, it is intuitive, and easy to understand.

Second, it relates directly to the specific air pollutants of concern in each area where project proposals are being considered for funding. For instance, in a metropolitan area such as Dallas, which is a moderate nonattainment area under the 8-hour ozone standard, the analysis would consider whether or not the proposed package of projects helps contribute toward ozone reduction. Meanwhile, a proposed funding program in Salt Lake City, Utah would consider whether or not the package of projects contributes toward reduction of PM-10 and does not increase CO, since this region is designated as nonattainment for PM-10 and maintenance of CO.

Third, detailed emissions analysis and modeling may not be required. In some cases it may be appropriate to conduct a qualitative analysis. The analysis would be simpler, and quicker to conduct. It also likely allows more flexibility to experiment with innovative approaches where air quality analysis techniques are not well established.

Weaknesses. There are several weaknesses associated with this form of performance metric.

First, a simple “positive” or “negative” rating does not account for the magnitude of emissions benefits. A one kg reduction in a pollutant is treated equally as a 1,000 kg reduction. This metric also does not directly address the level of benefits in terms of ultimate health effects, since it does not account for population exposure or other factors that influence social benefits. However, a tiered structure of ratings could potentially address this issue.

Second, it does not allow for a detailed ranking of funding proposals, but simply serves as a sort of screening mechanism to determine whether or not a proposal is contributing toward air quality goals.

Finally, it will be more difficult for regions with multiple air quality problems to demonstrate improvement for each pollutant of concern. It is important to note that although every project in a nonattainment or maintenance area must be in “conformity”, this does not mean that projects cannot result in increased emissions. To meet conformity, the project must be from a conforming Plan and Transportation Improvement Program (TIP), and may need to conduct “hot spot” analysis, in some circumstances. Consequently, there may be some projects or packages of projects that increase emissions, but are still meet required conformity tests. This metric examines the contribution toward meeting regional air quality objectives by reducing pollutants of concern.

OTHER ENVIRONMENTAL ISSUES

A wide range of other environmental issues, including water quality, habitat/ecosystems, wetlands, and community impacts can be addressed in a performance measure framework for evaluating project proposals. In developing environmental performance measures for use in determining funding of project proposals, it is important to recognize that specific environmental issues differ across different parts of the country, depending on topography, climate, water resource issues, and other factors. Therefore, developing one set of specific, quan-

tifiable metrics may not be feasible or appropriate. For instance, while net acreage of wetlands is a potentially important national performance metric¹⁷², this may not be an issue in desert areas of Arizona, or other climates and locations where there are few wetlands. Similarly, the nature of habitats varies widely across the nation, and developing specific measures of different types of wildlife and vegetation affected (e.g., birds, small mammals, native vegetation) may be too specific for use in a national performance measure framework for comparing project impacts.

A further challenge is that much of this type of environmental analysis may need to occur at the NEPA stage, when a project proposal has already undergone extensive analysis, and may not be available for all projects or programs being submitted for consideration for competitive funding. In some cases, no analysis of environmental impacts may be readily available, so new analyses would need to be conducted. This is particularly true of programs that involve travel demand management (TDM), pricing, bus replacements, and other strategies that do not involve construction of new infrastructure. If the funding program that is established focuses on energy and climate change issues, presumably many of the project/program proposals will focus on strategies that do not involve major new highway or transit capacity, and will have limited other environmental effects.

POTENTIAL PERFORMANCE MEASURES

Given the wide diversity of environmental issues faced across the nation, this section briefly identifies environmental issues for consideration in the performance measure framework, and potential performance metrics.

¹⁷² FHWA committed under the Federal Clean Water Action Plan to provide compensatory mitigation on Federal-aid highway projects that results in a net increase of wetland acreage of at least 50 percent over a 10-year period from 1996 to 2006, and used this metric as one of its national performance measures in its Environmental Performance Measures Report. See: <http://www.fhwa.dot.gov/environment/perform/index.htm>.

Water Quality

Water quality is broadly recognized as an important issue for human health (i.e., for maintaining clean drinking water), as well as for the health of fish and other aquatic wildlife. In the early 1970's, a growing awareness of the potential for water-quality degradation due to highway runoff resulted in the enactment of environmental laws, executive orders, and policies that protect water quality. The acts and their requirements in relation to highway runoff include the following:

1. The National Environmental Policy Act (NEPA) and the Clean Water Act of 1972, as amended hold federal decision makers accountable for activities having the potential to impact features of the natural environment-in particular, water quality (Bank, 1993).
2. The National Pollutant Discharge Elimination System (NPDES) regulates stormwater discharges and requires NPDES permits in certain circumstances. It also requires discharge permits for industrial and municipal (point source) effluents containing pollutants. Effluent regulations include characterization of stormwater runoff, possibly originating directly from highways and the construction and maintenance of the highway systems.
3. The Nonpoint Source (NPS) Management Programs, Clean Water Act, Section 319 also promotes the implementation of best management practices regarding highway runoff, as a potential nonpoint source pollutant of surface and ground water.
4. The Department of Transportation (DOT) National Transportation Policy (NTP), the Federal Highway Administration (FHWA) Environmental Policy Statement (EPS), and the Intermodal Surface Transportation Efficiency Act (ISTEA) through SAFETEA-LU specify increased environmental

responsibilities for policies and programs developed by federal and state transportation agencies.

5. The Coastal Zone Act Reauthorization Amendments (CZARA) regulate highway-runoff water quality and its environmental impacts in coastal areas.
6. Other legislation such as the Safe Drinking Water Act, the Endangered Species Act, the Resource Conservation and Recovery Act, and The National Wild and Scenic Rivers Act also contain provisions that may pertain to the water quality of highway runoff.

There are a number of potential performance measures relevant to water quality at a state or regional level, including compliance with National Pollutant Discharge Elimination System (NPDES) permit requirements,¹⁷³ and tracking of efforts to minimize runoff, such as through characterization of the percent of runoff treated through bioswales or assessing compliance in implementation of an erosion and sediment control plan for all transportation construction sites.¹⁷⁴ However, these metrics are not well geared toward assessments of specific project proposals.

Potential metrics that could be used in a framework of evaluating projects for competitive award of funding include:

- Change in amount of impervious surface – This has been used as an indicator in some DOT efforts to make broad assessments of watershed health. For

instance, Maryland State Highway Administration has developed a schema accounting for amount of impervious surface created and runoff water treated from such surfaces. Washington State DOT calculates the amount of impervious surface in the watershed when deciding the viability of wetland restoration investments therein. This could be calculated on a project-based level.

- Contribution to reduced runoff pollution and wastewater from transportation infrastructure - This metric could account for implementation of mitigation and enhancement elements, and thereby encourage inclusion of these elements into project proposals for funding.

Habitat and Ecosystems, including Wetlands and Wildlife

Habitat and ecosystem effects are important impacts of the transportation system as a whole, and often are important considerations in individual transportation investment decisions. A wide range of potential metrics can be used to assess habitat and ecosystem effects, including:

- Preservation or loss of high-quality wildlife habitat (i.e., total acres affected, type, such as wetlands, old-growth forests, grasslands);
- Elimination or mitigation for culverts that block fish passages;
- Minimization of habitat fragmentation;
- Effects on wildlife mobility from wildlife crossings

For purposes of developing a metric for use in evaluation proposed projects for funding, a general qualitative metric could be developed termed “Preservation/ enhancement of habitat”, which could account for various considerations listed above.

173 North Carolina Department of Transportation and Maryland State Highway Administration (SHA) operate systems that can report on the percentage of construction sites in compliance. Washington DOT’s system allows analysis of trouble areas, to identify where supplementary education and technical assistance may be needed.

174 Maryland SHA has also begun to characterize the extent to which the agency is minimizing runoff pollution and wastewater from infrastructure, through characterization of the percent of runoff treated through bioswales. The agency also tracks and is continuously improving maintenance and performance of previously constructed stormwater treatment BMPs in the ROW.

Noise and Other Community Impacts

Noise, and other community impacts (often considered the “human environment”) are also important considerations that must be analyzed as part of NEPA documents for transportation projects. Historically, community impacts have sometimes been overlooked in project decision-making; however, these issues are very important to people, and therefore, it is valuable to include some measures of community impacts as part of the environmental evaluation framework. Typically, community impacts are considered in the following categories.¹⁷⁵

- Sociocultural effects (e.g., community cohesion, impacts on community facilities and cultural resources)
- Safety/health (e.g., effect on crime and sense of safety, emergency response, bicycle/pedestrian safety)
- Sensory/aesthetic effects (e.g., noise, vibration, viewshed, community focal points)
- Displacement of businesses, residents, community facilities, and/or farmland
- Economic effects (e.g., effects on property values, tax base, access to businesses)
- Land use effects (e.g., change in accessibility, consistency with future land use plans)
- Mobility/accessibility (e.g., access to businesses, travel patterns, connectivity)

Just like the other types of environmental effects noted above, these impacts may vary widely in their scope,

¹⁷⁵ Federal Highway Administration. “Community Impact Assessment: A Quick Reference for Transportation.” 1996.

making it difficult to come up with specific quantitative measures of each effect. Some quantitative evaluation metrics, however, are being developed to assess what has historically been more qualitative analyses of issues, such as community cohesion.¹⁷⁶

Specific community impacts will need to be identified as part of a project’s NEPA analysis, and approaches to avoid, minimize, or mitigate for adverse impacts should be considered, as well as enhancement opportunities during the environmental review process. Consequently, a simple set of “yes-no” measures, or a simple tiered rating scale (e.g. high positive impact, low positive impact, neutral, low adverse impact, high adverse impact) could be used as part of the performance evaluation. These might include addressing the following questions:

- To what extent does the proposal affect community cohesion, interaction, and access, accounting for issues such as displacement of residents and businesses?
- To what extent does the proposal affect sensory/aesthetic conditions?
- To what extent does the proposal encourage land use change consistent with plans?

SUMMARY OF OTHER ENVIRONMENTAL METRICS

In summary, there are a wide range of energy and environmental issues that can be considered as part of a framework for building performance measures into the selection of projects for funding. Although several of these considerations, including energy security, greenhouse gases, and air quality are linked, they each have unique attributes, which suggests the need for independent performance measures. Table 4 below provides a

¹⁷⁶ Cambridge Systematics, NCHRP Project 8-36. “Improved Methods for Evaluating Social, Cultural, and Economic Effects of Transportation Projects.” Transportation Research Board, 2008 (in draft).

Table 4: Summary of Potential Additional Environmental Performance Metrics

<p>Air Quality</p>	<ul style="list-style-type: none"> ■ VMT reduced ■ Criteria pollutant emissions reduced (e.g., kg/day or tons/year of CO, NOx, VOC, PM2.5, PM10) ■ Composite measure of total emissions reduced ■ Contribution toward attaining/maintaining air quality standards 	<p>Contribution toward Attaining / Maintaining Air Quality Standards (positive, neutral, negative)</p> <p>Or</p> <p>Composite air quality score, reflecting weighted emissions reductions</p>	<p>Estimate changes in travel characteristics (VMT, speeds, etc.) and vehicle fleets; may be based on travel demand modeling, sketch planning tools, or other approaches. Use MOBILE model or MOVES model (or similar outputs) to estimate criteria pollutant effects</p> <p>For monitoring, conduct similar assessment, based on collected data (e.g., transit ridership, surveys, etc.)</p>
<p>Other Environmental Effects</p>	<p>Multiple potential measures considered for various types of environmental effects</p>	<p>Tiered scale:</p> <p>Water quality:</p> <ul style="list-style-type: none"> ■ Change in impervious surface area ■ Contribution to reduced runoff pollution and wastewater <p>Habitat & Ecosystems</p> <ul style="list-style-type: none"> ■ Preservation/ enhancement of habitat <p>Community Effects</p> <ul style="list-style-type: none"> ■ Effects on community cohesion, interaction, and access ■ Effects on noise, vibration, and aesthetics ■ Encourages land use change consistent with plans 	<p>Determination of effects would need to be conducted based on an environmental scan of the proposed package of projects, and using a standardized scale for rating performance. In some cases, GIS and project-level environmental analyses, if available, would be a basis.</p> <p>For monitoring, environmental management systems or other tracking procedures could be established to assess effects periodically</p>

summary of the various metrics considered, as well as procedures that would be used for forecasting and monitoring performance. The measures include both quantitative metrics and qualitative ratings of performance.

In regard to establishing an appropriate performance measure framework that accounts for these energy and environmental issues, several observations are noted below.

Nature of Forecasting and Assessing Project

Impacts. It is important to note that metrics to be used for purposes of rating or ranking proposed projects (or packages of strategies, projects, and programs) for funding purposes will differ from performance measures that are typically used to assess a region or state's own progress in meeting environmental goals. System-wide measures, such as per capita measures (e.g., VMT per capita) are less useful, while measures that examine the impacts of the specific set of projects being proposed in comparison to a baseline are important. This analysis typically requires some reasonable assessment of a baseline forecasts, and a specific analysis of the forecast benefits of the proposed package of projects. Monitoring data, such as total VMT, fuel consumption, or air quality concentrations within a region or state, typically cannot be used to assess the on-going effects of funded projects. Aggregate measures are influenced by many factors beyond the strategies themselves, such as fuel prices, economic growth, and demographic factors. As a result, examining the effects of implemented projects typically will require some data collection to assess travel changes, speed changes, or other direct effects of the projects being implemented (e.g., through surveys, before-and-after studies, etc.), and this information will then be used to calculate estimated effects on energy consumption, GHG emissions, or air pollution effects.

Limitations of Existing Travel and Emissions Analysis Tools. The use of performance metrics will require

use of travel and emissions analysis tools, many of which are known to have limitations for analyzing certain types of transportation strategies. Travel demand forecasting models use a variety of inputs on the transportation network, demographics, destinations, land uses, and economic conditions, and vary substantially in their technical capabilities. Many cities and urban regions use models that do not explicitly account for travel made by foot, bike, or transit. While some models incorporate feedback mechanisms between land use changes, transportation networks, and auto ownership, others do not. Consequently, the capability to assess the impacts of land use strategies, and non-traditional transportation programs, such as incentives, outreach programs, and traveler information is limited. Off-model, sketch planning analyses or other approaches may be needed. In addition, emissions models, including MOBILE6, are known to have some limitations in analyzing the effects of strategies that reduce traffic congestion levels. EPA's MOVES model addresses some of these limitations, but a thorough analysis may require more data inputs.

Need to Specify Appropriate Data Collection and Analysis Methods.

In order to compare investments across geographic areas, the outputs of models used in different areas should be comparable. Given the recognition that models differ in their capabilities, and the fact that some transportation strategies cannot be analyzed effectively in traditional travel demand forecasting models, there is a need to ensure that appropriate assumptions and methodologies are used, even in cases where sketch planning analyses are applied. This is a somewhat challenging task, as can be seen from a review of project analyses of emissions effects conducted for the CMAQ program. Although the lack of rigorous analysis requirements from FHWA may have contributed to wide diversity of approaches, a recent analysis of a sample of CMAQ funded projects found a wide range of assumptions and analysis procedures used, often with

limited documentation or data to support assumptions regarding travel impacts of proposed projects. If funding may be tied to the forecast energy and emissions benefits of projects, it will be important to apply a more rigorous standard to the analyses. This may require more administrative time for the federal agencies overseeing the new funding program, and require more technical support and tools development to ensure adequate

analyses. At the same time, it will be important to ensure that the requirements are not onerous to the extent that they discourage participation.

As mentioned in the body of this report, none of these metrics are meant to substitute for existing federal environmental requirements under the National Environmental Policy Act, Clean Air Act, or the Clean Water Act.

Appendix B: Technical, Research, and Policy Consultants

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Appendix C: Understanding the Models

NETWORK UTILITY

Traditional operations research identifies connectivity as a key input to accessibility, where a network has higher accessibility when it is better connected. Note that this type of accessibility is based on the design of the network and not necessarily the opportunities available within identified network isochrones. Measures of network connectivity include:

The number of roadway links divided by the number of roadway nodes: A higher index means that travelers have increased route choice, allowing more direct connections for access between any two locations.

A **Directness index** can be calculated by dividing direct travel distances by actual travel distances. For example, if the network is well connected, people can travel nearly directly to destinations, resulting in a low index. If the network has many turns or unconnected dead ends, people must travel farther to reach destinations, resulting in a higher index.

Nodal degree: A network can be represented by a connectivity matrix, which expresses the connectivity of each intersection with adjacent intersections. The number of columns and rows in this matrix is equal to the number of intersections in the network and a value of 1 is given for each cell where there is a connected pair and a value of 0 for each cell where there is an unconnected pair. The summation of this matrix provides a very basic measure of accessibility, also known as the nodal degree.

Total connectivity can be defined by a total connectivity matrix. The connectivity matrix used to develop nodal degree does not take into account all the possible indirect paths between nodes. Under such circum-

stances, two nodes could have the same degree, but may have different total connectivity. To consider this attribute, total connectivity can be used to calculate the total number of paths in a network, which includes direct as well as indirect paths.

MAXIMUM UTILITY OR LOG SUM MEASURES FOR ACCESSIBILITY

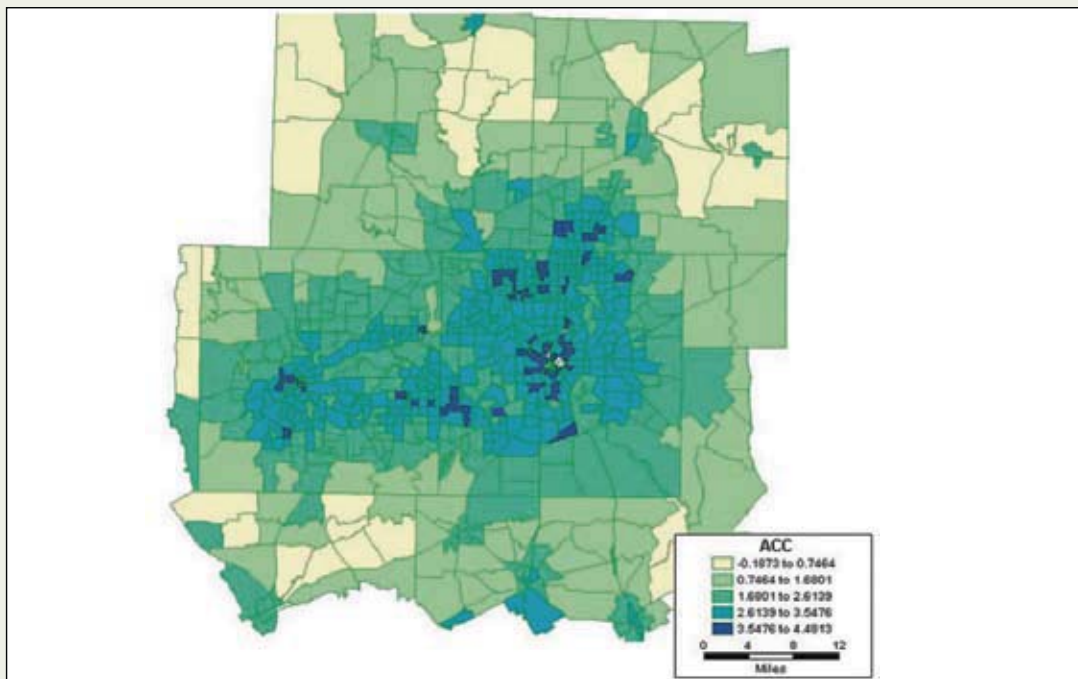
Log sum measures have characteristics similar to those based on the gravity model; however, they are more comprehensive since they incorporate the typical distribution of travel distances. Technically, the maximum utility approach uses discrete choice models of travel choice and is based on the multinomial logit (MNL) mode choice model. This model is commonly used to model mode split in a metropolitan region. MNL models are also common in marketing, where companies identify target markets through models of consumer choice.

This type of measure is based on an individual's perceived utility for different travel choices and combines the impedances of distance, travel time, and costs, among many others associated with traveling between different markets and social characteristics.¹⁷⁷ In other words, the log sum measure allows for longer or farther trips as the utility associated with the trip is based on more than disutility of distance alone.

These models also allow for aggregation across dimensions, which is important for program evaluation. Where a cumulative opportunities measure can show access to jobs only or access to universities only for one specific population or by zone, the log sum measure can be aggregated to include a distance parameter, mode choice parameter, time of day (peak or off-peak, for example), as well as for any and/or "all" trip purposes considered. The output is then one accessibility measure based on the combined probability of selecting zone Z1 for

¹⁷⁷ Development of an Urban Accessibility Index: Formulations, Aggregation, and Application.

Figure 13 : Utility-Based Accessibility Values for Social-Recreational Trips using the Highway Mode at Peak Travel Time



Development of an Urban Accessibility Index: Formulations, Aggregation, and Application. The University of Texas at Austin.

residence, and selecting mode M1 during time of day T1 to pursue a trip purpose P1.¹⁷⁸

Note that while an aggregate measure can be shown for one or more dimensions, for example, accessibility for *all trip purposes* using the highway mode at peak travel time, disaggregate measures can also be shown, for example, accessibility values for social-recreational trips using the highway mode at peak travel time (Figure 2). Additionally, one summary measure of accessibility can be developed: accessibility for all regions or zones, for all times of day, for all modes, for all trip purposes.

178 Development of an Urban Accessibility Index: Formulations, Aggregation, and Application. Equations 3.15, 3.16, 3.17, and 3.18.

In Figure 13, note that the urbanized or downtown areas where most people work and that are well-served by the highway system have relatively high levels of accessibility in some cases; however, outlying areas also show high accessibility levels, since park lands were used as the proxy for recreational trips.¹⁷⁹

Although the number assigned by the utility-based accessibility model is dimensionless, it allows for a base accessibility number to be developed for a region and then compared to forecasts based on the transportation program proposed.

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In a study completed for the Texas Department of Transportation (TxDOT), the accessibility metric was calibrated on a scale from 0 to 1, which allows for comparisons across regions.¹⁸⁰ Additionally, the measure of accessibility can be divided by the sensitivity of cost in the region. Mathematically, this is the coefficient of the cost variable in the MNL model. This transforms the accessibility of a metropolitan area, for example, to the cost of living in that metropolitan area.¹⁸¹

A utility-based measure (based on MNL model) provides the only model of metropolitan accessibility that reveals actual travel choice across various dimensions. As such, this is the best measure of urban accessibility. Measures of minimum travel time as well as measures of land use alone (not discussed in detail in this report) are not recommended since they do not capture the interaction between land use and transportation with respect to traveler choice.

THE MNL MODEL

The log sum multinomial logit (MNL) model is a sophisticated model that reflects how people actually make choices within a specific metropolitan region and can be run on a standard personal computer. Accessibility measures derived from the MNL model include utilities associated with each choice parameter and are based on actual regional travel patterns from data that MPOs already collect. The MNL model is driven by transportation choices and can be used to show changes in access based on projects programmed in a region, which are already modeled to consider future travel demand. While complex, this is a standard choice model used in marketing and is common place in transportation planning because of its application for regional mode choice.

■ Utility-based accessibility measures include four dimensions:

- Spatial
- Modal
- Trip type (work, non-work, etc.)
- Time of day (peak versus off-peak).

Applying this model allows for the development of an aggregate measure, which can serve as one single regional measures of accessibility: for all zones, modes, trip types, and travel times. It should be noted that the accessibility measure is dimensionless and most applicable for comparing changes within a transportation program rather than across programs or metropolitan areas. Additionally, a utility-based measure will not be applicable for non-urbanized areas; however, Section 6: National Connectivity will better address accessibility in rural regions.

For measures of basic metropolitan accessibility, the following aggregations are suggested for urbanized areas within a state:

- A peak-period regional accessibility measure - for all zones, all modes, and all non-work trips during peak periods, and
- An off-peak regional accessibility measure - for all zones, all modes, and all non-work trips during off-peak periods.

Access to varying social opportunities as well as regional services is an important component of accessibility as well as access for certain populations or groups. A utility-based measure can be used to disaggregate non-work trips to show opportunities

¹⁸⁰ Development of an Urban Accessibility Index: Formulations, Aggregation, and Application.

¹⁸¹ Dr. Chandra Bhat. The University of Texas at Austin. Phone interview. Aug 7, 2008.

to health care alone, for example. It should be noted that much less data are available for these social and recreational opportunities, and that the TxDOT research used access to parklands as a proxy for recreation. Impedances for other social opportunities can certainly be estimated, however, and relevant market charges can be applied. For example, the TxDOT research provides examples of accessibility measures for shopping trips, where more data are available.

To supplement measures of regional accessibility, cumulative opportunities isochrones can also be applied to show access to the other social opportunities. It should be noted, however, that the intent of these measures is to show the effect of transportation on accessibility. While land-use

decisions will have longer-term effects on access and should be considered, it is essential not to ignore transportation enhancements in the promotion of land use changes.

The utility-based MNL model recommended for a regional measure of accessibility will include the disutility of traffic congestion, for example, on limiting accessibility without adequately providing for transportation modes that people within the region *actually* use. While congestion is an important input to the accessibility measure, we would like to underscore the importance of continuing to report on basic measures of congestion in the short-term, especially until accessibility measures are better understood and more widely implemented.

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