

LEADERSHIP INITIATIVE ON TRANSPORTATION SOLVENCY



ROAD *to* RECOVERY

Transforming America's Transportation

BILL BRADLEY • TOM RIDGE • DAVID WALKER



CARNEGIE ENDOWMENT

FOR INTERNATIONAL PEACE

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About the Leadership Initiative on Transportation Solvency

The Leadership Initiative on Transportation Solvency will develop a nonpartisan solution for funding an improved and self-sustaining transportation system in the United States. Under the guidance of three distinguished leaders and public policy experts, the initiative will conduct an analysis of strategies to fund America's transportation system that are politically realistic but also serve to make transportation better, greener, and more fiscally sound.

Leadership Team

The Honorable William W. Bradley **Former U.S. Senator**

Senator Bill Bradley is a managing director of Allen & Company LLC. Bradley served in the U.S. Senate from 1979 to 1997, representing the state of New Jersey. He was a senior adviser and vice chairman of the International Council of JP Morgan & Co., Inc. from 1997 to 1999. During that time, he also worked as an essayist for CBS *Evening News* and was a visiting professor at Stanford University, the University of Notre Dame, and the University of Maryland. From 2001 to 2004, he acted as chief outside adviser to McKinsey & Company's nonprofit practice.

The Honorable Thomas J. Ridge **Former Pennsylvania Governor and** **Homeland Security Secretary**

Tom Ridge is president and CEO of the international consulting firm Ridge Global, headquartered in Washington, D.C. He served as the nation's first secretary of the U.S. Department of Homeland Security from January 2003 through January 2005, and as the assistant to the president for Homeland Security from October 2001 through December 2002. Previously, he was governor of the Commonwealth of Pennsylvania from 1995 through October 2001 and a member of the U.S. House of Representatives from 1983 to 1995.

The Honorable David M. Walker **Former U.S. Comptroller General and Founder and** **CEO of the Comeback America Initiative**

Dave Walker is founder and CEO of the Comeback America Initiative. He served as the seventh comptroller general of the United States and as head of the U.S. Government Accountability Office for almost ten years. This was one of his three presidential appointments, each by different presidents from both major political parties, during his sixteen years of federal service.

Staff

David Burwell **Director, Energy and Climate Program**

David Burwell is director of the Energy and Climate Program at the Carnegie Endowment. His work focuses on the intersection between energy, transportation and climate issues, and policies and practice reforms to reduce global dependence on fossil fuels.

Shin-pei Tsay **Director, Leadership Initiative on** **Transportation Solvency**

Shin-pei Tsay is the director of the Leadership Initiative on Transportation Solvency. Prior to joining the Carnegie Endowment, she served as deputy director of Transportation Alternatives, one of the leading nonprofit advocacy organizations in the United States, where she provided strategic direction and overall management of the staff and organization.

Contact the Initiative

Carnegie welcomes your comments and feedback on the initiative. Email project staff directly at:

transportation@ceip.org



The U.S. highway trust fund is broke.



Unaccountable spending is undermining America's long-term strategic priorities and the nation's infrastructure is crumbling. Failure to reform the transportation system risks deepening the United States' dependence on oil, eroding economic competitiveness, and increasing climate disruption. Waiting to make real improvements only drives up future costs, whereas responsible policies can improve transportation and reduce the national deficit today.

The Leadership Initiative for Transportation Solvency is dedicated to developing a nonpartisan solution to fund a better transportation system in the United States. Former U.S. senator **Bill Bradley**, former Pennsylvania governor and secretary of Homeland Security **Tom Ridge**, and former U.S. comptroller general and current president of the Comeback America Initiative **David Walker** led an intensive analysis to find politically realistic measures to fund and fix the transportation program.

In recent years, the U.S. surface transportation system added nearly \$175 billion annually to the national deficit, including deferred maintenance. The United States is one of only a handful of countries in the world where revenues raised to support the federal transportation system do not cover costs. Revenues represent just 62 percent of federal surface transportation expenditures, while all other members of the Organization for Economic Cooperation and Development, the group of developed economies, more than cover 100 percent of their transportation expenditures through user taxes—and sometimes several times over.¹ Also, the practice of deferred maintenance unnecessarily contributes to this burden by increasing the cost of system upkeep to as much as \$800,000 per lane mile over the life of the road.²

There are tangible economic benefits from the transportation system apparent in the ability of households and firms to access markets. But the benefits are waning. The rate of economic return from investment in highway infrastructure in the United States has been approaching the long-term interest rate (cost of capital) since the 1990s. Once the rate of economic return meets the long-term interest rate, it becomes equally beneficial to keep invested capital in the private sector,³ a clear signal that those investments could be without merit. At that point, the system no longer delivers the benefits necessary to justify public funds. While a 2011 national public opinion poll found that 79 percent of the public agrees that “in order for the United States to remain the world’s top economic superpower we need to modernize our transportation infrastructure and keep it up to date,” in the same poll 64 percent of the public felt that federal spending on transportation infrastructure is “inefficient and unwise.”⁴

Not only is there an enormous fiscal burden, but the system’s dependence on oil intensifies the problem. Oil represents 94 percent of transportation fuels and transportation is responsible for nearly 75 percent of U.S. oil consumption. In 2010, our national bill for oil dependence came to \$323 billion—2.2 percent of GDP. This includes the importation of foreign crude oil and petroleum byproducts, and the dollar amount equals 17 percent of all import

FACT

\$175 BILLION

amount added annually to the national deficit by the U.S. surface transportation system, including deferred maintenance



costs.^{5,6} This dependence comes with a national security risk: some 4.75 million barrels per day (about 50 percent of total imports) were purchased from nine countries categorized by the State Department as unstable.⁷

Oil dependence also hinders our ability to deal with climate challenges. Thirty-four percent of U.S. carbon emissions come from the transportation sector and 80 percent of the carbon is emitted exclusively by internal combustion engines.⁸ Research conducted by NASA's Goddard Institute for Space Studies and other climate agencies finds that on-road transport has the greatest negative effect on climate—more than power generation or any other sector—especially in the short term.⁹

While the country suffers the effects of an increasingly degraded and underperforming transportation system, investment decisions on the nation's transportation system have become increasingly unfocused, short-term, and highly politicized.¹⁰ In 1987, President Ronald Reagan vetoed a transportation funding bill because it contained 100 earmarks; in 2005, President George W. Bush signed a subsequent transportation funding bill containing 6,229 earmarks without objection. Since the completion of the Interstate Highway System more than twenty years ago, states and metropolitan areas have cobbled together their own project and investment plans for highway, transit, and rail, but this piecemeal approach prevents the smooth integration of local, state, and federal policies and hinders potential synergies across projects. This approach also compromises federal oversight and accountability, making it difficult to measure performance and set appropriate authorization levels for the future.



These shortfalls in our federal transportation program do not justify abandoning federal transportation assistance—quite the opposite, actually. A nation’s transportation system is a major actor in its economy, deserving investment and requiring federal funding and oversight. Changes to the system will help ensure future economic growth, recognize demographic and geographic shifts in both population and preferences, advance environmental and energy security, and embrace and support innovation. All of these items are necessary to maintain global competitiveness and guarantee future prosperity. For example, higher levels of federal transportation investment are merited in urban areas where more than two-thirds of the country’s population now lives and there are economic, environmental, and social benefits that can be gained. Instead of simply building capacity—as the current transportation program tacitly promotes—incremental investments in a mature U.S. transportation system should be applied sensitively and the prioritization of project investments can be evaluated through economic analysis.

Realizing the many benefits from a functional transportation system requires a national vision and greater accountability by using performance metrics derived from strategic goals. But without new revenue to meet transportation infrastructure needs, the benefits of any restructuring will remain largely unrealized. Systematic pricing is required for the transportation system to serve the public interest in a responsive, trustworthy, and cost-effective manner. **Twenty-first century transportation policy necessarily draws a close relationship between program design *and* its funding mechanism.**

Pricing transportation and better optimizing transportation investments will also bring tangible security and prosperity gains. Benefits accrue to

individuals and society as a whole. These benefits include reductions in fuel consumption and pollution, public health improvements including better respiratory health and greater levels of physical activity, more efficient movement of goods, services, and passengers, and economic benefits through clusters of firms with convenient and affordable transportation and communications networks.

Strategies for pricing transportation abound. Options include pricing the carbon content of fuels, low-mileage vehicles, inefficient travel behavior, and emissions in the development of refined petroleum products.

For the nation's economic, energy, and environmental security, we, three leaders representing the U.S. political spectrum, recommend that a solvent transportation program be ensured through the stable pricing of oil and petroleum products as the best immediate strategy. This strategy reflects the current transportation system and its dependence on oil by capturing and distributing the external, social, and hidden costs generated by the production, refining, distribution, and consumption of such fuels.

Specifically, our proposal assesses a 5 percent ad valorem tax on oil upstream (at production or importation) as the world oil price rises, and tax on gasoline/diesel downstream (retail sales) as the world oil price declines. This will dampen oil demand on the way up (to avoid a price spike) and slow price crashes on the way down (to encourage price stabilization and recover reductions in ad valorem tax revenues due to lower oil prices). If prices get too high or too low despite these efforts, the ad valorem tax can be recalibrated, as necessary, to stabilize transportation fuel costs while also funding a transportation program designed to advance federal goals. Benefits of this strategy include distributing revenue responsibilities along the oil value chain from production to consumption; buffering the impact of external events and oil supplies over which the United States has no control; and stabilizing fuel prices for both producers and consumers for long-term market equilibrium.

It is time for a significant recalibration of America's federal transportation program. Poorly designed and obsolete programs must be eliminated. At the same time, America needs more targeted investment in projects that grow the economy and serve the key national objectives of security and prosperity. System costs—direct and hidden—must be incorporated into the pricing system to again fund transportation on a pay-as-you-go basis. Further delay in implementing these reforms only accelerates deterioration in the system while causing transportation's contribution to the national debt to snowball. Kicking the can of revenue and program reform down the road does not help us live within our means—it simply transfers these burgeoning costs to future generations of Americans. This is both short-sighted and unfair. We can delay no longer: the time to act is now.

FACT

75%

transportation is responsible for nearly 75% of all U.S. oil consumption



The Depths of Transportation Insolvency

The United States' federal surface transportation program is insolvent. There is a significant shortfall between the amounts that are collected and expended because fuel taxes and other transportation fees are not sufficient to cover costs. The U.S. general fund is being tapped to fill this financial gap. Moreover, this shortfall is causing underinvestment in system maintenance, saddling future generations with mounting transportation expenses.

This transportation insolvency could not come at a worse time. The federal government's debt has increased dramatically in the past few years. If this situation remains unchanged, the debt will grow by \$7 trillion in the next decade. And if the

debt continues to expand faster than the nation's economy—as it has since 2007—the share of federal spending devoted to paying interest on the debt will rise, and the risk of a fiscal crisis will increase. According to the Congressional Budget Office,

At their current levels, the taxes in effect are insufficient to fully fund the existing amount of federal surface transportation spending. To avoid worsening the fiscal outlook, any policies that widened budget deficits in the near term would need to be accompanied by specific policies to reduce spending or increase revenue over time.¹

Current U.S. transportation spending practices exacerbate this fiscal weakness. The federal government puts itself into greater debt to finance transportation projects. In 2011, outlays are projected to exceed revenues and interest credited to the general fund by about \$12 billion.²

The fiscal dysfunction of the transportation system compromises the United States' productivity and its ability to compete globally. The United States is one of only a few developed nations whose transportation program cannot be fully funded from transportation revenue sources. Other nations are also able to generate additional revenue from their transportation system to cover the costs of other government programs, thus contributing to rather than only receiving from, general revenues. To confound matters, the United States does not know whether it is spending its limited transportation dollars wisely.

Beyond containing costs for and strategically funding tomorrow's transportation system, new revenue sources are needed to finance the system. Infrastructure should be priced according to the marginal (or incremental) cost of its use, including those related external costs that are imposed on society. For example, various studies suggest that the external costs of motor fuel use are at least \$1 per gallon to fully reflect those costs.³

The transportation program must be able to support itself and cover its full costs through a tax, fees, tolls, or other assessments. This is the minimum prerequisite for a transportation system that contributes to the nation's long-term economic growth.

Direct and Indirect Hidden Costs Attributed to Transportation, Annual Average 2008–2010
(billions of dollars)

TABLE 1.1

Hidden Costs	Low Estimate	High Estimate
Net cash flows from General Fund	\$12 ^a	\$20 ^b
Interest on debt from General Fund expenditures	\$.348 ^c	\$.598
Deferred maintenance ^d	\$60	\$85 ^e
Productivity deficit	\$29 ^f	\$29
Hidden budgetary costs paid by agencies other than U.S. Department of Transportation	\$2 ^g	\$40 ^h
Total Estimated Transportation Annual Deficit	\$103.3	\$174.6

The High Cost of Transportation

The existing federal surface transportation program imposes as much as \$175 billion annually in unproductive, hidden costs. These expenditures draw down the general fund and add to the budget deficit, increase interest on the national debt, assess burdens through deferred maintenance, sap U.S. economic productivity, and inject indirect costs into the operations of a number of agencies (table 1.1).

In the United States, general tax revenues subsidize transportation services across all program areas—roads, rail, mass transit, air travel, and maritime travel. This report is concerned with surface transportation alone; roads, rails, and mass transit add \$12 billion annually to the deficit, and \$20 billion if stimulus infrastructure funding is included. These transportation expenditures from the general fund at a time of severe budget deficits incur additional interest on the debt, from \$348 million to nearly \$600 million. The lack of adequate funds further imposes hidden costs by requiring deferred maintenance on the order of another \$60 billion to \$85 billion annually. Suboptimal investment to increase gross domestic product (GDP) due to the poor allocation of transportation funds adds \$29 billion in hidden costs. Transportation expenses are also indirectly incurred by many federal agencies other than the Department of Transportation, amounting to as much as \$40 billion annually. The Department of Energy and the Department of the Interior, for example, incur expenses to regulate and facilitate the fueling of transportation; the Department of Defense secures access to energy

TABLE 1.1

NOTES: All figures are rounded to the nearest whole dollar. ^aExcludes funding from the American Recovery and Reinvestment Act of 2009; excludes Building America Bonds funding and includes all money transferred from the general fund to the Highway Account in the Highway Trust Fund only. ^bWith American Recovery and Reinvestment Act funds; excludes Building America Bonds funding and includes all money transferred from the general fund to the Highway Account in the Highway Trust Fund only. ^cAssumes 2.99 percent effective interest rate on marketable and nonmarketable debt as of February 2011. ^dDeferred maintenance is extremely difficult to calculate. These figures represent a low estimate based on the National Surface Transportation Policy and Revenue Study Commission and are a reflection of reported capital needs against revenue receipts and an estimated gap between those two values. A detailed discussion on the challenges of calculating deferred maintenance can be found later in the chapter. ^eNational Surface Transportation Policy and Revenue Study Commission Exhibit E-2, multiple sources. ^fAssumes a suboptimal investment GDP cost of 0.1 percent annually based on an analysis by the Congressional Budget Office. ^gAssumes that 0.1 percent of the current transportation-related federal agency budgets are spent directly or indirectly on transportation-related problems. ^hAssumes that 2.5 percent of current transportation-related federal agency budgets are spent directly or indirectly on transportation-related problems.

SOURCES: Congressional Budget Office, www.cbo.gov; U.S. Department of the Treasury, www.treasurydirect.gov/govt/reports/ir/ir_expense.htm and www.treasurydirect.gov/govt/rates/pd/avg/2011/2011_02.htm.

supplies abroad; the Environmental Protection Agency addresses vehicle pollution; and the Department of Health and Human Services deals with morbidity and mortality resulting from vehicles and fuels. These agencies must simply contend with the externalities of the U.S. transportation system.

Heavy Burdens on the National Deficit

The spending levels set by Congress in the most recent law reauthorizing the transportation program were calibrated to completely exhaust the balance of the Highway Trust Fund (HTF) over the law's 2005–2009 term and were based on optimistic projections of revenues that would be deposited into the HTF during the term.⁴ Predictably, gas tax receipts have not met projections, and since fiscal year (FY) 2008, Congress has transferred \$34.5 billion in general revenues into the Highway Account to keep the HTF solvent (table 1.2). This has maintained the HTF's balance to keep up with expenditures and state reimbursements.⁵ For the moment the Mass Transit Account remains solvent, though it is also projected to become insolvent in 2013.⁶

The Congressional Budget Office periodically releases projections of the HTF's solvency; the HTF is drawn down as payments (outlays) are made to states as after-the-fact reimbursements for work completed. In the office's spring FY 2009 baseline calculation, the Highway Account had outlays of \$35 billion for FY 2007 against receipts of \$34.3 billion. In FY 2008,

SOURCE: Douglas Elmendorf, CBO, "Spending and Funding for Highways," January 2011, www.cbo.gov/ftpdocs/120xx/doc12043/01-19-HighwaySpending_Brief.pdf.

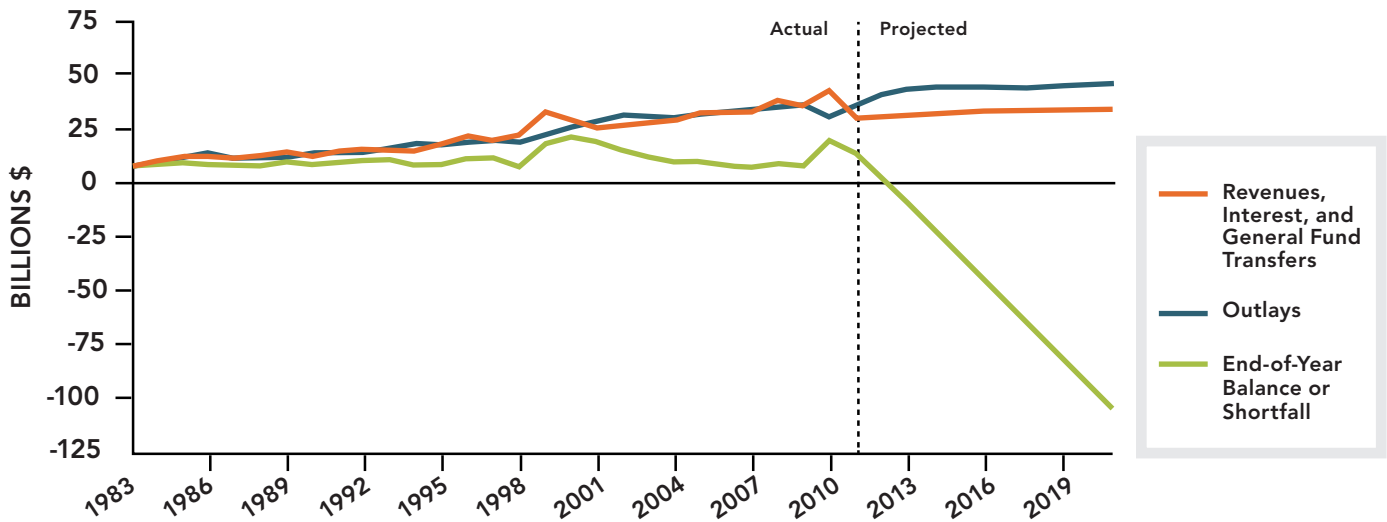
TABLE 1.2

General Funds Transferred to the Highway Trust Fund, 2008–2010

Date	Amount Transferred (billions of dollars)	Rationales for Infusion
September 2008	8	Emergency funds
September 2009	7	Keep the account solvent through the end of the fiscal year
March 2010	19.5	Reimburse the Trust Fund for interest payments not received since 1998
Total	34.5	

FIGURE 1.1

Status of the Highway Account of the Highway Trust Fund



outlays of \$37 billion were matched with only \$31.3 billion in receipts, not including an injection of \$8 billion into the HTF from Treasury general funds.⁷ The HTF had a balance of \$7.8 billion in February 2011 (figure 1.1).⁸

How did the nation get on this costly path? Americans are driving more and paying less, leaving the United States in uncharted territory. In 1956, America committed to build the Interstate Highway System, the largest public works project in history with a dedicated source of funding. For half a century, the federal gas tax generated enough revenue to completely fund the HTF, which comprises two separate accounts, one for highways and one for mass transit.⁹ During the past three years, however, there have been billions of dollars in transfers from the general fund to the HTF. The federal government’s spending on transportation has outpaced its ability to generate revenue from existing sources, including the federal gas tax.

The United States is operating with a \$1.4-1.5 trillion national deficit in FY 2011. It reached a historic rate of 9 percent of GDP in 2010, the second-highest shortfall since 1945. Net flows out of the general fund contribute directly to deficit spending, which further compounds interest on the debt. In FY 2010, the United States paid \$414 billion in interest on the federal debt.¹⁰ Financing this debt comes at a great cost; 13.6 cents of every \$1 raised by the government goes to interest payments.¹¹

FIGURE 1.1

NOTE: Under current law, the Highway Trust Fund cannot incur negative balances. The negative balances shown above illustrate the projected inability of the fund to pay obligations as they are incurred by the states. If the Highway Trust Fund were unable to meet its obligations in a timely manner, spending on programs financed by the fund could continue more slowly, to keep pace with tax collections. The Department of Transportation has stated that if the fund were to face a shortfall, it would ration the amounts it reimburses to states in order to maintain a positive balance in the fund.

SOURCE: Congressional Budget Office, “Highway Trust Fund and Paying for Highways” May 2011, <http://www.cbo.gov/doc.cfm?index=12173>

FIGURE 1.2

Transportation-Related Revenue as a Percentage of Federal Road Expenditures

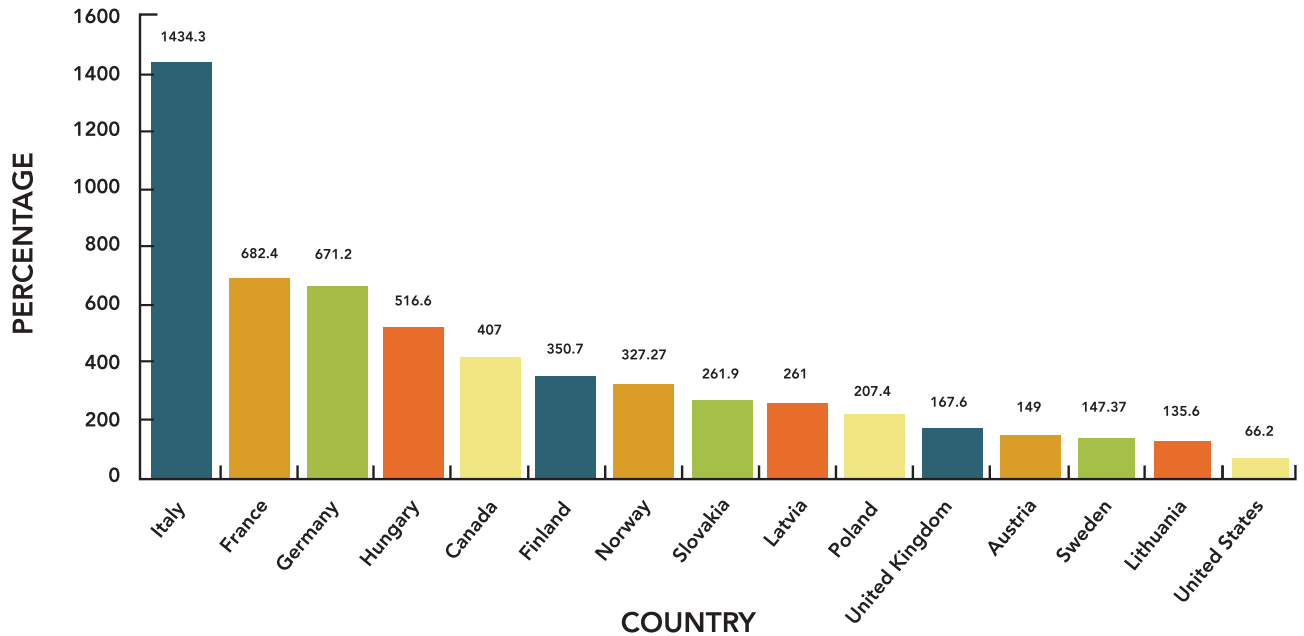


FIGURE 1.2

NOTE: In most countries, transportation user-fees contribute to general revenues and usually contribute more than the transportation program receives back. Because the funding structure of each transportation program is unique, however, an examination of only federal-level transportation revenues and expenditures may not provide the complete picture. Included here are countries for which transportation data were available.

SOURCES: Authors' analysis using data from Michel Audige et al., "Road User Charges: Current Practice and Perspectives in Central and Eastern Europe," Transport Paper TP-23, World Bank, November 2008; Bureau of Infrastructure, Transport, and Regional Economics of the Australian Department of Infrastructure, Transport, Regional Development, and Local Government, "Public Road-Related Expenditure and Revenue in Australia 2009," November 2009, www.bitre.gov.au/publications/38/Files/IS37_RoadExpend.pdf; Canadian Ministry of Transport, Infrastructure, and Communities, "Transportation in Canada 2009: An Overview," June 2010, www.tc.gc.ca/media/documents/policy/overview2009.pdf; Cesar Queiroz, "An Overview of Road User Charging Systems," PowerPoint presentation at workshop on road user charging systems sponsored by the Polish Ministry of Transportation and World Bank, June 11–12, 2007; and Federal Highway Administration, U.S. Department of Transportation, "Status of the Federal Highway Trust Fund," October 2009, www.fhwa.dot.gov/policyinformation/statistics/2008/fe10_2009.cfm.

Jeopardizing the Future With Inadequate System Maintenance

The transportation deficit is accrued in the future through deferred maintenance. There is wide agreement that avoiding system upkeep pushes costs onto future generations, though estimations of the cost of deferred maintenance remain challenging to calculate due to the structure of the federal transportation program and its funding mechanisms (see chapter 2). Some experts put the price tag of deferred maintenance at up to \$200 billion annually.¹² Studies have found that spending \$5 million on preventive maintenance can save \$100 million to \$500 million in rehabilitation and reconstruction costs.¹³ Although postponing maintenance may appear inescapable given the current shortfall of transportation funds, this deferred maintenance will cost America dearly; projections place its cost at a staggering \$5 trillion by 2035 (in 2010 dollars).¹⁴ It is estimated that it would cost three times the transportation system's \$1.4 trillion present asset value to replace it if it were not kept in a state of good repair.¹⁵ According to Lawrence Summers, the former White House economic adviser, "You run a deficit both when you borrow money and when you defer maintenance that needs to be done. Either way, you're imposing a cost on future generations."¹⁶

The current federal transportation program emphasizes capital improvements rather than preventive maintenance, which increase the cost of delivering transportation services over the life of the transportation facility. For example, inadequately maintained roads can add \$800,000 to the overall lifetime cost per lane mile of surface transportation infrastructure.¹⁷ It could cost even more to rebuild America's poorly maintained mass transit systems. And these amounts do not include the costs to travelers for delays, lost productivity, and accidents due to system breakdown.

Losing Productivity in the Global Marketplace

The United States is one of the few developed countries in the world that does not charge sufficiently to directly cover the costs of its transportation system.¹⁸ In fact, Americans pay 66 cents of every \$1 of total transportation system costs (figure 1.2). This situation disadvantages America competitively. Underfunding and unsound pricing for a transportation system builds in inefficiencies that result in waste and misallocation of resources. The shortfall of funds also imposes costs that ripple throughout the U.S. economy, as discussed above, in terms of deficit spending, interest on the debt, and deferred maintenance.

Hiding Costs in Other U.S. Agencies' Budgets

The current system hides a host of external costs from system users, contributing to the public's fiscal burden. An immediate source of hidden costs can be found in U.S. agencies other than the Department of Transportation.

"You run a deficit both when you borrow money and when you defer maintenance that needs to be done. Either way, you're imposing a cost on future generations."

—Lawrence Summers, former White House economic adviser

FACT

\$5 TRILLION

projected cost of required transportation maintenance in 2035 (in 2010 dollars) if postponed

TABLE 1.3

Federal Executive Department Expenditures That Relate to Surface Transportation

Federal Agency	Mission	2010 Budget (billions of dollars)	Budget Related to Transportation
Environmental Protection Agency	Protect human health and safeguard the natural environment—air, water, and land	10	Air pollution, climate change, oil spills, leaking underground storage tanks, solid waste
Department of Energy	Advance the national, economic, and energy security of the United States	23	Energy security, energy efficiency, energy conservation, environmental effects of energy production and use
Department of Health and Human Services	Protect the health of all Americans and provide essential human services, especially for those who are least able to help themselves	700	Morbidity and mortality attributed to automobile accidents and public health caused by automobile emissions
Department of Housing and Urban Development	Address America's housing needs, improve and develop the nation's communities	40	Smart growth, livable communities, mobility, and access
Department of the Interior	Protect America's natural resources and honor our responsibilities to American Indians, Alaskan Natives, and island communities	16	Energy resource extraction and its impacts, collect royalties
Department of Agriculture	Develop and execute policy on farming, agriculture, and food	95	Programs and subsidies related to corn ethanol and biofuels
Department of Commerce	Promote economic development and technological innovation	7	Programs and investments related to the automobile and oil industries
Department of Defense	Provide the military forces needed to deter war and to protect the security of the country	530	Programs and missions related to oil security
Department of Homeland Security	Prevent terrorism; protect the American people, critical infrastructure, and key resources; and respond to and recover from incidents that do occur	55	Energy security and transportation infrastructure security
Department of Justice	Enforce law, ensure public safety, provide federal leadership in preventing and controlling crime, seek just punishment for those guilty of unlawful behavior	25	Transportation-related accidents, crime, and punishment
Department of Labor	Ensure a strong American workforce	50	Workforce issues
Department of State	Develop and implement the president's foreign policy	35	Diplomatic relations on energy security and climate change
Department of the Treasury	Promote economic prosperity and ensure the soundness and security of the United States and international financial systems	13	Collect and disperse transportation-related taxes, account for oil- and automobile-related subsidies



Numerous government agencies are tasked with addressing a wide array of programs and problems related to transportation. However, these agencies do not pay into the HTF to finance these federal programs. The agencies that assist surface transportation, their missions, and their 2010 budgets are detailed in table 1.3. In their entirety, those federal agencies whose work relates, at least in part, to transportation expended \$1.6 trillion in 2010. Even if only a small fraction of these funds are used to address the costs imposed on society through the use of the nation's transportation system, this amounts to tens of billions dollars in federal outlays.

Although the Department of Transportation, the primary agency responsible for the nation's transportation system, has an annual budget (2005–2010) of about \$70 billion, the price of mitigating the societal costs of transportation absorbed by other federal agencies is substantial and growing. The Environmental Protection Agency and Department of Energy, for example, have divisions responsible for transportation-related environmental and energy concerns, and a portion of their budgets can be related to transportation insolvency. Still other agencies—including the Department of Health and Human Services, Department of Housing and Urban Development, Department of Agriculture, and Department of the Interior—have missions that relate indirectly to transportation fuels, infrastructure, and public health concerns.

TABLE 1.3

SOURCE: *White House, www.whitehouse.gov/our-government/executive-branch#cabinet.*

Mobilizing Economic Growth and Development

Between 2005 and 2040, the U.S. population is expected to grow by 100 million, a 30 percent increase. But compared to the 1960s when the country spent about 4 percent of GDP on infrastructure, today it spends

only around 2 percent.¹⁹ Moreover, America's spending on transportation infrastructure is less than both China (9 to 12 percent) and the much more geographically compact Europe (5 percent).²⁰

America's underinvestment in transportation means that its mobility alternatives are circumscribed. U.S. investment in transportation infrastructure does not optimize its contribution to economic growth. Roads dominated by cars and trucks outstrip all other modes. There is a limited capability to handle both recurring and nonrecurring disruptions—a huge lost opportunity. Studies show that infrastructure investment, targeted strategically, underpins economic productivity. Spending on infrastructure creates access to jobs, stimulates long-term economic growth, and engenders a multitude of other positive economic activities.²¹

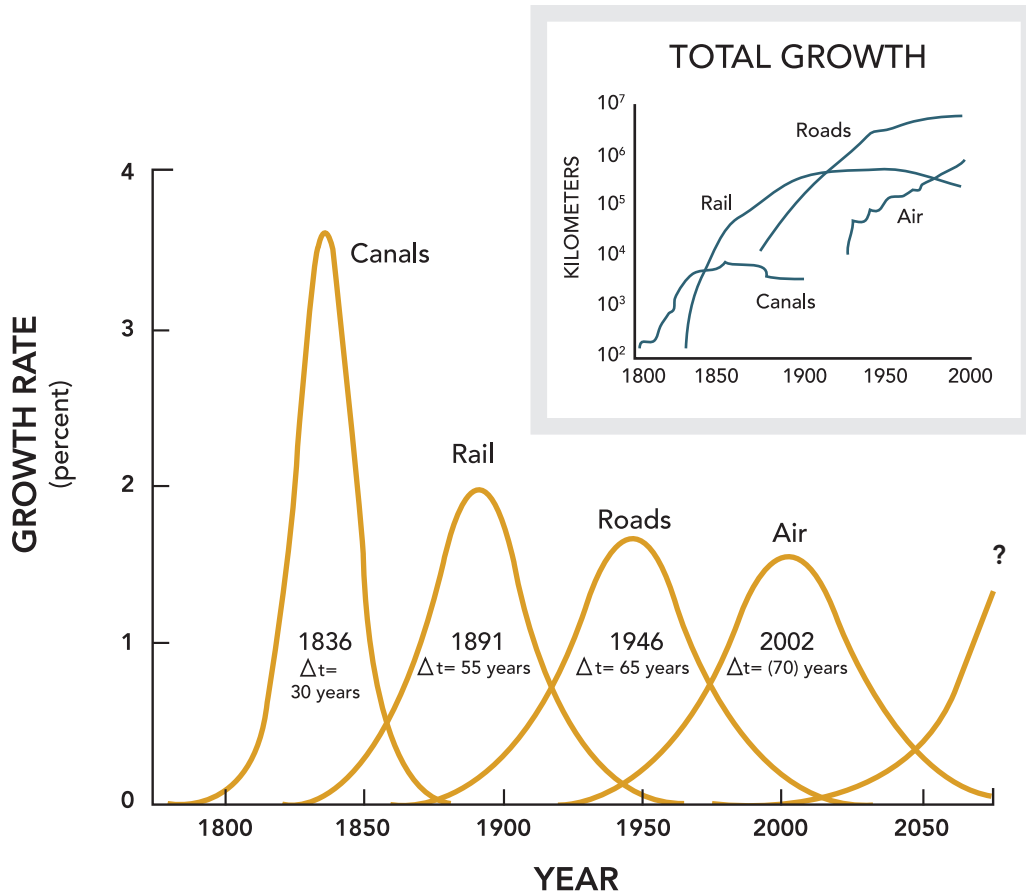
History Shows Strong Growth Potential Through Transportation

The United States has a history of infrastructure investment for the benefit of the greater public good. In 1792, for example, Congress appropriated \$15,200 for the construction of the Cape Henry Lighthouse in Virginia—the first infrastructure construction project under the new Constitution. The lighthouse guided ships to safe passage around the shoals of the Chesapeake Bay, thus supporting the new nation's economy.²² And in the early 1800s, the construction of the Erie Canal across New York state reduced the cost of transporting wheat from the Ohio Valley to East Coast markets by 90 percent.²³ Soon thereafter, railroads connected the East and West coasts, reducing the time of transcontinental travel from three months to two weeks. More recently, the Interstate Highway System connected state capitals and interstate markets across the entire country, providing productivity returns on an investment of more than 25 percent annually in the 1960s and early 1970s.²⁴ As transportation infrastructure and technology advance, America prospers.

The history of transportation technology can be seen as a striving to increase speed at progressively lower cost to expand levels of income. A steady substitution of transportation investments fits closely with a model based on growth and decline following the S-shaped logistic equation.²⁵ Depiction of the rates of growth of the infrastructure reveals a historic peak brought about by transportation investments every fifty to sixty years. The next investment wave might be high-speed rail. Or the Internet and continued advances in information technology could transform transportation to bring about the next wave of productivity gains (see figure 1.3).

FIGURE 1.3

Historical Rates of Growth of the U.S. Transportation Infrastructure



The peaking of transportation-derived economic growth has been slowing over time. In the early stages of a nation’s economic development, when transportation infrastructure is scarce, almost any transportation improvement generates a high return on investment. However, the ability of these infrastructure investments to yield high-productivity returns is constrained once the system is built and matures.

Flattening Returns on Current Transportation Investments

Net productivity returns on transportation infrastructure tend to diminish as the transportation system becomes more mature, and they can evaporate altogether if incremental investments in the system are not carefully targeted to provide maximum improvement in the system’s total

FIGURE 1.3

SOURCE: Jesse Ausubel, Cesare Marchetti, and Perrin Meyer, “Toward Green Mobility: The Evolution of Transport,” *European Review*, vol. 6, no. 2 (1998).

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efficiency. This principle is reflected in an analysis of the marginal productivity return on investment over the course of building the Interstate Highway System during the past fifty years.²⁶ This system's initial construction, for example, represented steep economic returns from the transportation system. But once constructed, investments on the same scale in new highways are inappropriate due to "steeply diminishing returns."²⁷ The rate of return can be calculated based on logistical and inventory cost savings for firms. Studies have found that annual returns were as high as 18 percent in the 1970s but fell to a mere 1 percent by the 1990s.²⁸

Looking at macroeconomic indicators, current transportation projects in the United States create more net public costs than benefits. According to a recent study, the rate of economic return to invested highway capital is approaching the long-term interest rate (cost of capital).²⁹

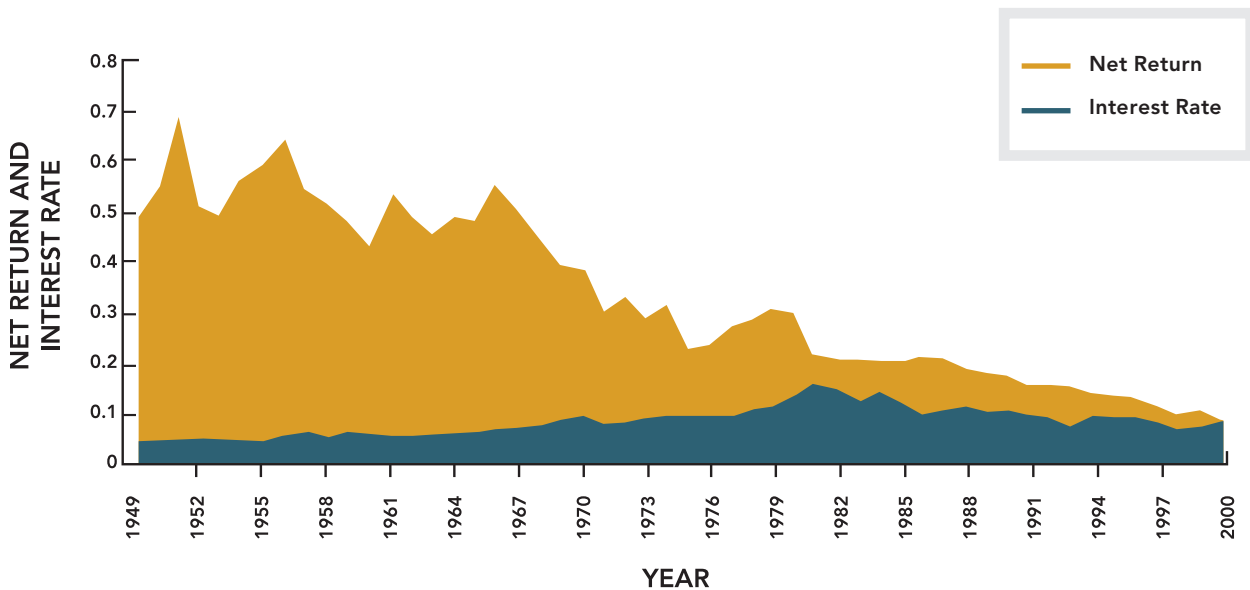
Economists have developed various measures of macroeconomic benefit that corroborate the return on investment pattern, as displayed in figure 1.4.³⁰ It has been demonstrated that transportation-intensive industries

FIGURE 1.4

SOURCE: Theofanis Mamuneas and Ishaq Nadiri, "Production, Consumption and Rates of Return to Highway Infrastructure Capital," preliminary draft, August 2006, https://editorialexpress.com/cgi-bin/conference/download.cgi?db_name=IIPF62&paper_id=11. Reprinted with permission.

Recent Transportation Projects Have Costs That Exceed Benefits, Net Return to Highway Capital, and Long-Term Interest Rates

FIGURE 1.4



displayed faster growth in total factor productivity (TFP) as a result of highway capital investment between 1951 and 1973, but “after 1973 the TFP growth impact evaporated.”³¹

Tying Transportation Investments to Productivity and Growth

To justify the investment of public funds, spending on highways has historically attempted to increase economic productivity by improving the cost, speed, and reliability of transportation. History suggests that there may be more productive investments to meet future mobility needs. Plowing massive investments into conventional roadways may be ill advised from a growth perspective. Transportation, after all, is a means to an end, not an end in itself. And in a national context, this end is economic growth. Therefore, transportation investments should catalyze growth in three important ways.³²

First, transportation projects may lead to gains in TFP, which are often realized in the form of “agglomeration economies”—which simply means that interconnectedness and density benefit firms through knowledge spillovers, greater supplier access, and larger labor markets. Indeed, it has been asserted that “without increasing returns to scale in the context of transportation improvements, it is impossible to account for the observed spatial concentration of firms and regional specialization in regional and national economies.”³³

Second, reduced transportation costs may lead to increased output in transportation-using sectors, mostly by reducing firms’ inventory and logistical costs. And third, macroeconomic benefit is likely to be derived from additional tax revenues to the degree to which transportation investments increase land values and/or enhance access to higher-paying jobs.

Public investment in transportation infrastructure remains appropriate. It is estimated that for every 0.1 percent increase in the rate of GDP growth, the deficit could be reduced by \$288 billion over ten years.³⁴ The federal government now spends about \$70 billion annually on all modes of surface, marine, and air transportation, about \$52 billion of which is devoted to roads, rails, mass transit, buses, and connecting infrastructure (stations, transfer hubs, access improvements, and so on). The arguments for additional investment to support America’s competitive position in a growing global economy are well documented and compelling.³⁵ However, the massive sums committed to public capital investments in transportation infrastructure need to be strategic, efficient, and backed up by cost-benefit analyses that target the total benefits to society as the core purpose of investment.

FACT

1%

the rate of return on federal transportation investment fell to less than 1% by the 1990s

Conclusion

The U.S. transportation program is ensnared in a declining financial spiral that is causing its insolvency, and thus it cannot make the investments that could grow the economy and thereby raise the revenues needed to return it to financial health. In surmounting this decline, the program faces three major hurdles:

1. Transportation is contributing to the national deficit—general revenue subsidies are now required to fund an inadequately financed transportation program.
2. System upkeep is insufficient—deferred system maintenance will saddle future generations with mobility disruptions and burden them with economic hardships and costs that will grow beyond the system’s value.
3. Investments are not geared toward economic growth—under-investing in strategic infrastructure jeopardizes productivity and inhibits competitiveness.

Transportation spending raises economic productivity by improving the cost, speed, and reliability of moving people and goods. Spending on highways has long satisfied this mandate, but the maturity of the U.S. system demands a reassessment of priorities—one that brings strong returns on investments.

U.S. policymakers must work to restore the nation’s transportation solvency. This will not be easy. But under today’s challenging economic conditions, America cannot afford to subsidize transportation projects with general funds. Continuing to build and maintain the transportation infrastructure through deficit spending is a losing proposition. Likewise, postponing today’s maintenance needs for the next generation could cripple the nation in the years ahead. Hidden costs attributed to transportation are continuing to mount, burying benefits that could otherwise be realized with transportation outlays. Hundreds of billions of dollars in direct outlays are at stake. It is time to make America’s transportation system productive, efficient, and solvent.



CARNEGIE ENDOWMENT *for* INTERNATIONAL PEACE





Pursuing Transportation Reform

Transportation decisions—and the investments resulting from them—have significant economic consequences. Strategic transportation investments backed by a sound program design and a solvent funding strategy could deliver significant benefits. At present, however, U.S. transportation investment decisions are largely haphazard and thus are made with little connection to national goals and objectives.

The nation's transportation program lacks guidance and direction at the same time that its roads are crumbling. This situation was not borne out of simple carelessness; it unraveled over time. Shifting transportation needs have increasingly conflicted with the original program structure. The original program did not establish sufficient

parameters for accountability, and recently special interests have been increasingly and routinely accommodated over the public good. A wide array of experts agrees that

America's transportation infrastructure has not kept pace with the growth and evolution of its economy. —Brookings Institution¹

What's needed is nothing less than a fundamental overhaul of America's transportation policies and programs. —Miller Center for Public Affairs²

Washington must implement an accountable, fiscally responsible and performance-driven national transportation policy. —Bipartisan Policy Center, National Transportation Policy Project³

We must start transitioning to a new paradigm now. If we don't start, we will never get there. —National Surface Transportation Infrastructure Financing Commission⁴

Numerous organizations have analyzed the federal transportation program and offered recommendations.⁵ The ultimate goal here is to assess the reform recommendations and consider how to rebuild the U.S. transportation system for the twenty-first century.

Diagnosing Problems With the Federal Transportation Program

Throughout American history, congressional involvement in building a national transportation system has been rooted in efforts to support economic growth and regulate interstate commerce. For the past 100 years—from the Pony Express to rails to roads—transportation investments have transformed the nation and shaped its economy, foreign policy, and human settlement patterns. In 1956, the Interstate Highway System was conceived for national defense purposes, and propelled forward with an initial infusion of \$27 billion.⁶ Although the system was declared complete in 1991,⁷ subsequent transportation bills have continued to fund a federal transportation program based largely on that original proposal.

In the discussion that follows, it becomes apparent that the nation has outgrown this original intent. This chapter focuses on the most recent transportation authorization—the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)—which became law in 2005 and has been extended past its initial expiration in 2009. (See appendix 2.1 for a history of previous authorizations.)

SAFETEA-LU authorized individual surface transportation programs, set-asides within programs, and further sub-set-asides, for a total of at least 150 programs. The law is divided into eleven titles.⁸ Some of the programs are duplicative, extremely small, or not authorized for the life of the law. To assess the most salient features of the individual programs, a number of programs are excluded from this analysis.⁹ The remaining titles—I, II, III, IV, and IX—represent the majority of authorized funding and contain core elements of the current transportation program.¹⁰ Categories of SAFETEA-LU programs along with their budgets are detailed in table 2.1.

TABLE 2.1 Categorization of Major SAFETEA-LU Programs and Budgets, 2005–2009

Agency	Number of Programs	Program Budget (billions of dollars)
Federal Highway Administration	51	194.99
Federal Transit Administration	21	44.62
Federal Motor Carrier Safety Administration	7	1.46
National Highway Traffic Safety Administration	9	3.04
Federal Railroad Administration	2	1.85
Research and Innovation Technology Administration	6	2.18
Outside U.S. Department of Transportation	12	4.54

TABLE 2.1 SOURCE: Authors' analysis based on authorizations in SAFETEA-LU.

Each of the 108 remaining programs is reviewed individually with respect to how it functions and whether its intended outcomes are achieved. The inquiry included questions about these topics:¹¹

- When did the government put the program or policy in place, and what were the conditions at the time?
- What is the program trying to accomplish?
- Is the program still a priority for today and tomorrow?
- Are similar programs and policies working in a coordinated and integrated manner?

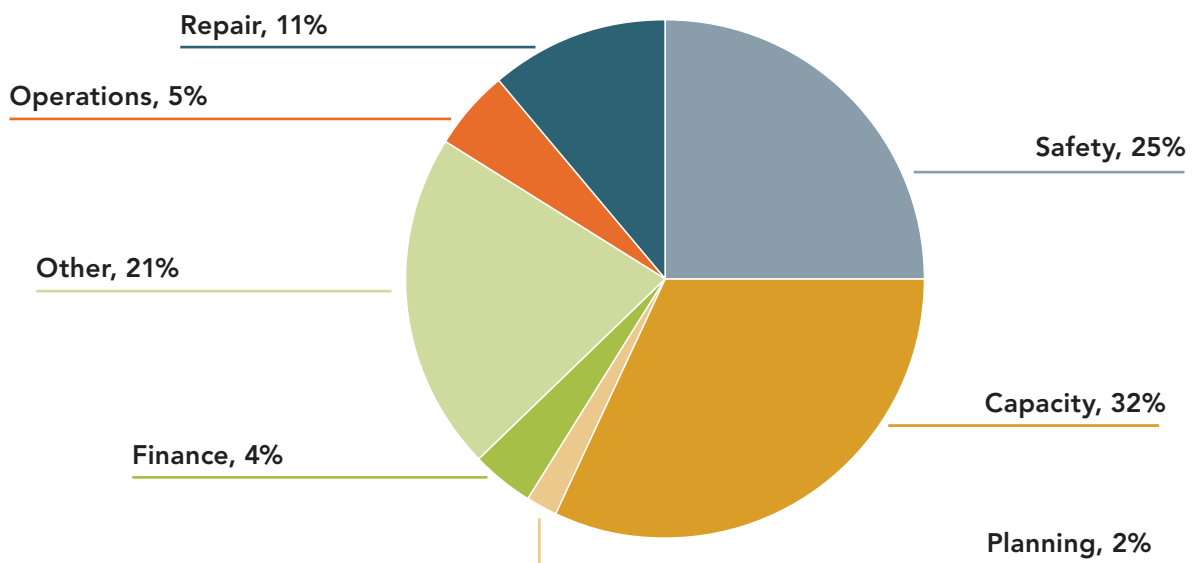
For more detail on the methodology, see appendix 2.2.

Program Intent Lacking With Little Accountability

Taken together, federal transportation programs have poorly defined purposes and almost no reporting or monitoring mechanisms. We identified

FIGURE 2.1

Percentage of Federal Transportation Programs, by Type



the intended uses of the programs and found that the largest number fall into three categories: new capacity, safety, and “other” (figure 2.1).¹²

An analysis of these programs reveals that the majority simply do not articulate objectives or abide by reporting mechanisms. Many of the large core formula programs have some eligibility limitations; most of the smaller ones do not specify clear goals or objectives for the funds. Three federal programs that target funds at large infrastructure projects—Projects of National and Regional Significance, the National Corridor Infrastructure Improvement Program, and the Coordinated Border Infrastructure Program—do not have clearly defined outcomes or statements of purpose. In a 2009 evaluation of these programs, the U.S. Government Accountability Office (GAO) concluded that their priorities were unclear; there was limited room for a criteria-based, competitive project-selection process; and there was little assurance that funded projects achieved the highest possible return on federal investments.¹³

Eligible uses or specific earmarks are often used in lieu of a program’s clear intent. The National Highway System, for example, lists eighteen project-eligibility criteria but does not state the program’s intent. There are no performance measures, project-selection reporting, or monitoring required.¹⁴ Other initiatives, such as the Projects of National and Regional Significance, have a stated purpose but offer a list of fundable projects instead of program objectives.

The ability to transfer funds between programs and to combine funds from different programs further obscures program intent. For example, while Interstate Maintenance funding is restricted to resurfacing, restoring, rehabilitating, and reconstructing (the “4Rs”), states can transfer up to 50 percent of their Interstate Maintenance apportionment to other unrelated programs. The law also allows states to transfer funds between highway and mass transit programs, from one state to another, or to the Federal Highway Administration for ease of administration to fund one or more eligible projects.¹⁵ Although the Intermodal Surface Transportation Efficiency Act of 1991 was enacted to allow states to have increased flexibility in better aligning their transportation programs with new national transportation goals, there is little evidence that this has happened. Still, the new flexibility written into the national transportation law is a sign that the original project-based program no longer fits new system needs. Furthermore, this reduces policymakers’ ability to track expended funds and plan meaningful authorization levels.

Weak Administrative Oversight

When it comes to transportation investments in practice, the federal government has very little oversight authority vis-à-vis states and regions.¹⁶

FACT

1991

the year the Interstate Highway System was declared complete

FIGURE 2.1

SOURCE: Author analysis based on *Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users*, 233 USC Sec. 101.

Responsibility for administering programs authorized by Congress falls to the U.S. Department of Transportation (DOT), which contains thirteen divisions—ten structured around individual modes (for example, highways, mass transit, marine) and three administrative branches. A few smaller programs authorized in the surface transportation law are administered by other agencies, such as the Department of the Interior and the Internal Revenue Service. DOT’s modal administrations are:

- Federal Highway Administration
- Federal Aviation Administration
- Federal Motor Carrier Administration
- Federal Railroad Administration
- Federal Transit Administration
- Maritime Administration
- National Highway Safety Administration
- Pipeline and Hazardous Materials Safety
- Research and Innovative Technology
- Saint Lawrence Seaway Development Corporation

Congress articulates very few requirements to ensure that projects funded with federal dollars are cost-effective or necessary or promote long-term economic growth. Authorizing legislation is limited to requirements related to fair wage rates, discrimination policies, and competitive contracting procedures. Contract authority—the authority granted to DOT to obligate federal funding for authorized projects before appropriations—increases the power of states to select projects with little federal oversight, especially because the federal transportation law declares that its provisions “shall in no way infringe on the sovereign rights of the states to determine which projects shall be federally financed.”¹⁷ Though this law gives states much-needed flexibility because of the wide range of different transportation needs from state to state, it largely gave away federal oversight. States are only expected to report to the federal government at the end of the project to arrange for reimbursement. This provides Congress with little assurance that federal funds are being effectively tar-



geted toward projects of national and regional interest. Worse, delegating too much power to plan, prioritize, and build projects to individual states means that federal transportation programs are implemented state by state without continuity or regional vision, leading to uneven, and sometimes negative, outcomes.

Weak administrative oversight calls program effectiveness into question. In an evaluation of DOT's research, development, and technology budget (totaling \$1.1 billion in 2006), GAO found that the DOT Research and Innovative Technology Administration (RITA) had not established performance goals, a clear implementing strategy, or an evaluation plan describing a process for coordination, facilitation, and review practices to ensure the effectiveness of the investment. The report concludes that "without such a strategic approach, it is difficult for RITA to ensure that DOT is making the most of approximately \$1 billion annual [research, development, and technology] investment."¹⁸

Complex, Inefficient, and Ineffective Funding Distribution

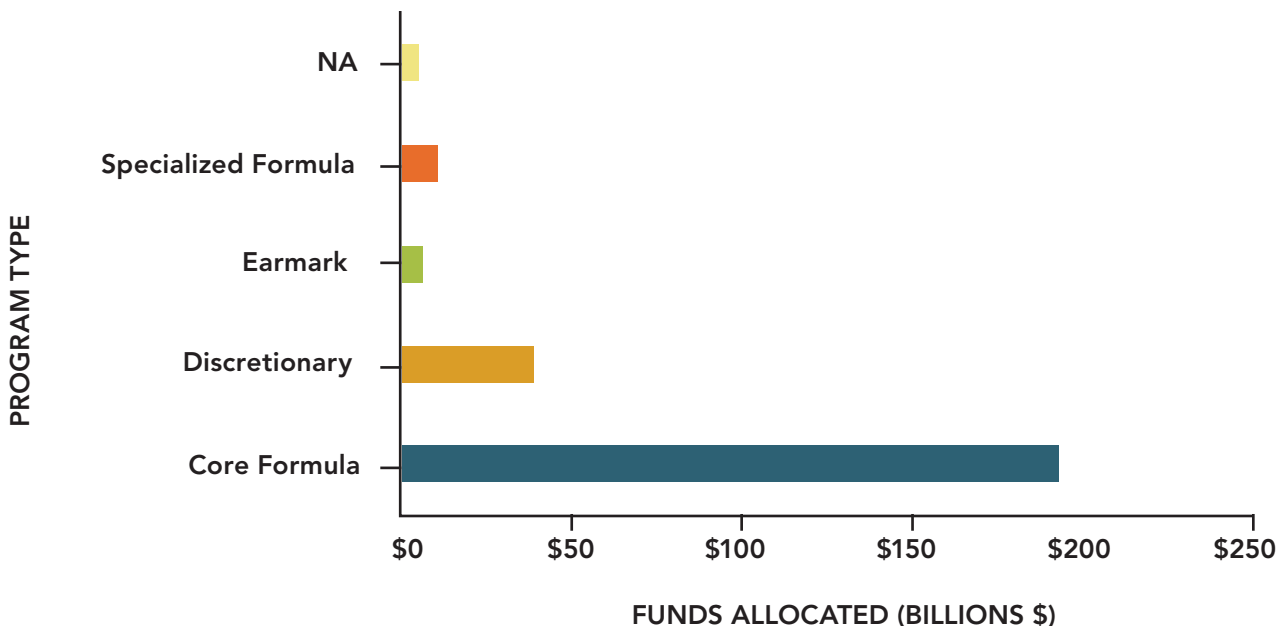
The funding mechanism for most transportation programs can be described as either formula (apportioned) or discretionary (grant) distribution. This distinction is significant. Formula programs make funds available to the states based on formulas set forth in the authorizing legislation. Discretionary programs are designed to allocate funds by competitive processes.¹⁹

A recent U.S. Treasury economic analysis of infrastructure investment found that the formula-based approach to distributing federal funds “virtually ensures that the distribution of investment in infrastructure is suboptimal from the standpoint of raising the productive capacity of the economy.”²⁰ Formula-based funding reduces the ability to make adjustments to funding even when higher-order priorities emerge. For the 108 surface transportation programs, more than \$200 billion was allocated to states and regions based on funding formulas. In sheer program shares, this represents nearly 40 percent of the total authorized under SAFETEA-LU (see figure 2.2), relinquishing control of a significant portion of federal funding to the states.

Most highway, mass transit, and safety grant funds are distributed through formulas that have only an indirect relationship to needs, and many have no relationship to performance or outcomes.²¹ The funding formulas for core highways programs are loosely based upon metrics intended to determine state funding needs (see appendix 2.3). Often, the formulas distort states’ funding decisions by automatically rewarding states for goals in programs that may conflict with goals in another program or plan. For example, the funding formula for the Interstate

FIGURE 2.2

Transportation Funds Allocated to States and Regions



Maintenance Program rewards states for increasing lane miles and vehicle miles traveled by allocating federal funds based on growth in these two indicators, even though reductions in these indicators are the goals of other federal programs and may be the goals of a state's long-range plans.

The misalignment between federal program goals and their execution by states is exacerbated by the increasing number of specialized programs, which have mushroomed to more than 100 since 2005. Of these, more than 80 percent of federal highway funding to states and municipalities is distributed by formula grants with little oversight. In at least one initiative, the Equity Bonus Program, funding formulas are conscientiously manipulated to secure sufficient votes to enact a transportation bill, regardless of need or program focus.²²

The lack of rigorous analysis to justify funding creates a sense of entitlement among states. Further, the fact that some states contribute more to the Highway Trust Fund (HTF) than others spurs ongoing debates about appropriate funding decisions.²³ The government initially created a Minimum Guarantee to ensure that states received a minimum proportion of its federal gasoline tax contribution. But even this has devolved; since 2005, almost every state has received as much or more funding for highway programs than it has contributed to the Highway Account of the HTF.²⁴ This is not only due to the creation of a new formula program—the Equity Bonus Program—whose sole purpose is to ensure states are guaranteed a minimum 92.5 percent of gas taxes “returned,” but can also be achieved only by drawing down HTF balances from previous years to make sure every state wins. This reinforces the sense of entitlement among states with little recourse; but more fundamentally, the combination of these factors illustrates how the federal program structure cannot keep pace with shifts in demand.

Rampant Earmarks

Earmarked programs represent a similarly disturbing trend of clashing goals and investments. What began as a way to ensure funding for projects of particular interest to individual states has ballooned into a huge share of total federal transportation funding. In 2005, fully 6,229 individual earmarks—\$25 billion in a five-year period—were included in SAFETEA-LU alone. And in 2006, an additional 7,808 earmarks were included in the transportation appropriations bill, accounting for about another \$8 billion. For example, the National Corridor Infrastructure Improvement Program (Section 1302) lists 33 projects eligible for funding, while the High-Priority Projects Program (Section 1701) lists 5,173. Put in tabular form, the list of earmarks totals almost 200 pages of the law.

FACT

80%

of federal highway funding is allocated without oversight

FIGURE 2.2

NOTE: “NA” refers to funding not overseen by the U.S. Department of Transportation and its modal administrations. These funds are overseen by other agencies, including the Internal Revenue Service and the Department of the Interior and therefore cannot be categorized as core formula, specialized formula, earmark, or discretionary.

SOURCE: Authors' analysis of total authorization level and types in SAFETEA-LU.

Earmarks are not subject to standard planning requirements; nor are they required to show that their benefits outweigh their costs. Instead, the rules for them currently only focus on full disclosure of the sponsoring entity to avoid conflicts of interest for members of Congress.²⁵

In reviewing the impact of earmarks on the administration of federal transportation programs, GAO found that a high number of earmarks circumvent state and regional planning processes and limit the transparency of decisionmaking. Earmarks displace higher-priority or regionally significant projects with lower-priority projects. GAO also found that some projects funded through federal earmarks are not identified as state priorities, thereby sidestepping adequate review. In addition, federal earmarks may provide only partial or start-up funding for a project, which leaves state and local governments with the task of obtaining funding to complete the project and cover future maintenance costs.²⁶

Unsustainable Funding Sources

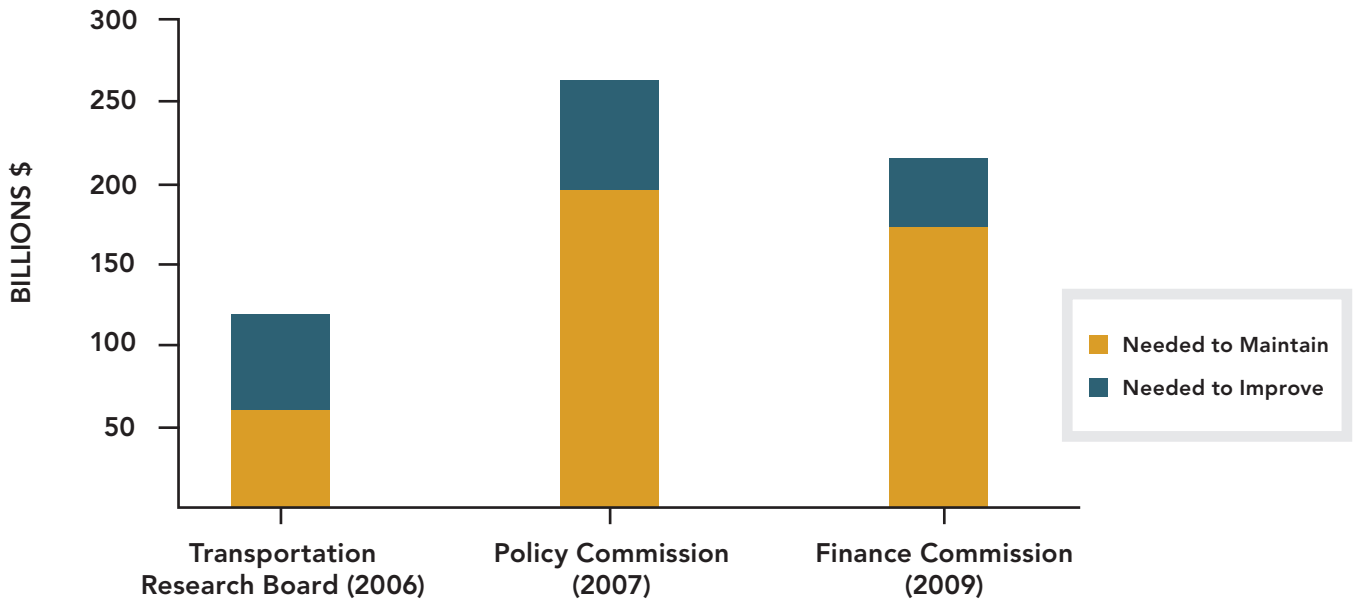
Perhaps most important, average annual funding on transportation programs continues to increase in spite of a lack of program guidance, distribution of funds for projects regardless of merit, and a lack of accountability. Since fiscal year (FY) 2005, transportation investment has stayed at about \$70 billion in federal funds, though rising 17 percent between FY 2006 and FY 2009.

Still, an increasing number of long-standing transportation investment needs go unmet. Projections of annual needs are much higher from all levels of government. In 2006 the Transportation Research Board estimated that each year an additional \$58 billion is needed to maintain the existing system, and \$119 billion is needed to improve it.²⁷ In 2007, the Policy Commission suggested that an additional \$194 billion per year was required just to maintain and \$262 billion to improve,²⁸ while the Finance Commission in 2009 suggested \$172 billion to maintain and \$214 billion to improve (see figure 2.3).²⁹

The Revenue Aligned Budget Authority (RABA), a stipulation in SAFETEA-LU that mandated minimum spending levels in spite of actual revenue declines in the HTF, is another example of how the structure is misaligned with current priorities. Congress originally designed RABA to ensure that it was “right-sized” to match federal gasoline tax revenues, the primary funding source. In years when more revenues were collected than had been projected, programs could expand; and in years when fewer taxes came in, programs would be reduced. But recently, revenue from the

FIGURE 2.3

Estimated Range of Additional National Transportation Investment Needs



federal gas tax has shrunk year after year; in fact, the HTF was projected to reach insolvency by 2013 due partly to known causes such as changing driving patterns, the global economy, and higher fuel efficiency standards. The spending down of the HTF accelerated because SAFETEA-LU prohibited programs from being reduced when gas tax receipts were lower than expected at the same time that it allowed increases in spending when gas tax receipts were higher than anticipated. So it was during this time when gas tax revenues decreased dramatically that programs, armed with RABA, rapidly drained the HTF.³⁰

Although the efficacy of funding decisions is subject to different interpretations and may vary depending on analyses and projections, taken together, the results are clear: Current transportation programs are not structured to ensure that projects deliver a high enough level of national and regional performance. This is of particular concern given the reality of diminishing revenues for the federal transportation program.

FIGURE 2.3

NOTE: The dollar figures represent the value of the year stated. Interest rates during this period were relatively low enough for the values to still have utility in comparison.

SOURCES: Author analysis based on National Surface Transportation Infrastructure Financing Commission, *Paying Our Way: A New Framework for Transportation Finance*, February, 2009; National Surface Transportation Policy and Revenue Study Commission, *Transportation for Tomorrow*, January 2008; Transportation Research Board, *Future Financing Options to Meet Highway and Transit Needs*, NCHRP Project 20-24(49), December 2006.

The Federal Transportation System Is Missing the Mark

The Department of Transportation’s mission is to “serve the United States by ensuring a fast, safe, efficient, accessible, and convenient transportation system that meets our vital national interests and enhances the quality of life of the American people, today and into the future.”³¹ Under this rubric, recent indicators suggest that the current transportation system is missing the mark and may be doing more harm than good.

U.S. roads are not as safe as they should be. Nearly 35,000 people are killed each year on them—the equivalent of a Boeing 737 airliner crashing every weekday. Moreover, about 2.5 million people are injured on U.S. roads every year.³² The annual economic cost of these traffic-related tragedies is estimated at \$230 billion. The American Automobile Association estimates that crashes impose an annual “tax” of \$1,050 on every American.³³ Those residing within 984 feet of major highways are more likely to have asthma, leukemia, and cardiovascular disease, conditions that are extremely debilitating and costly in terms of private and public health care expenditures.³⁴

The U.S. surface transportation infrastructure, which is intended to deliver mobility in an efficient and safe manner, instead subjects drivers to traffic congestion that stifles commerce and impedes mobility around cities and along freight corridors across the nation. The average rush-hour commuter spends a full workweek stuck in traffic each year, and together commuters annually waste 3.9 billion gallons of fuel and incur a direct cost of \$115 billion (in 2009 dollars).³⁵ Demand for freight transportation is expected to double by 2035, yet there is no long-term plan to address mounting congestion. The failure to address system inefficiencies adds to the cost of moving goods and threatens America’s economic competitiveness.

For old, young, poor, or disabled people, for whom personal vehicles may not be a viable option, today’s transportation system is neither convenient nor accessible. Low-income households in rural areas spend about 42 percent of their total annual incomes on transportation, compared with middle-income households, which spend less than 22 percent. The lack of adequate transportation forces half of nondriving senior citizens to stay

FACT

35,000

people are killed each year on U.S. roads; 2.5 million are injured



home each day,³⁶ and this situation will only become more severe because the U.S. population is aging.³⁷ By 2050, more than one in five Americans will be over the age of 65, increasing the needs for convenient and accessible transportation options.³⁸

This lack of options imposes significant costs on Americans. Households in areas that are auto-dependent spend an average of 25 percent of their income on transportation, compared with 9 percent for households in areas that are well served by mass transit.³⁹

Ensuring a safe transportation system presumes a high degree of structural integrity. Across the nation, drivers face more than 90,000 miles of crumbling highways and more than 70,000 structurally deficient bridges.⁴⁰ In 2009, the American Society of Civil Engineers awarded the condition of the nation's bridges a C grade, roadways a near-failing D-, and mass transit systems a D.⁴¹

The nation is not receiving high returns from its current transportation investments. Along all dimensions, it is missing the mark. Poor investments put a price tag on the opportunity costs of a system in need of major reform. We explore the benefits and costs of better transportation investments further in chapter 4.

Conclusion

The results of this diagnosis of the federal transportation system indicate that current programs are structured in ways that do not achieve optimal investment results. Each of the exposed problem areas presents opportunities for reform with tangible benefits:

- Unclear programmatic intent makes it impossible for Congress to ensure that federal funding is targeting national goals and interests.
- The Department of Transportation's oversight is limited to procedural reviews and guidance assessments that do not ensure that state and regional decisionmaking achieves economic outcomes and furthers national goals.
- The lack of quantifiable performance benchmarks hinders state reporting and challenges federal oversight.
- Complex funding formulas obscure how money is being spent.
- Earmarks distributed to states are unrelated to actual state funding needs and circumvent planning and project prioritization procedures.
- Unsustainable funding—with a limited role for innovative finance mechanisms, private investment, and long-term maintenance funding assurances—hampers highway and mass transit programs.
- Authorization levels are not in line with the costs of the work needed to maintain the current system and projections of future maintenance costs, including the effects of deferred maintenance.

These trends belie a deeper problem: that national transportation investment decisions have become reactionary, short-term, and highly politicized. Further, this analysis confirms that of the over 100 programs that make up the federal transportation effort, only a handful offer clearly stated goals, and even fewer have reporting requirements or accountability mechanisms. The use of formula-based funding distribution, congressional

earmarking, and discretionary program project lists complicates the connection between activities and outcomes. Too few federal transportation programs have funding levels tied to the achievement of results.

The federal transportation effort is now a loose collection of parochial interests. Despite the successful completion of the Interstate Highway System in the 1980s, the federal government's current broad transportation program structure, funding mechanisms, and implementation process are nearly the same as they were in 1956. Thus, the United States is entrenched in a transportation system that is structured according to those priorities from more than half a century ago. But the nation's transportation programs and investments instead must be reformed to meet twenty-first-century goals and challenges.



1921/1925	Congress adopts federal-aid system and begins establishing routes.
1931	Federal gas tax of 1 cent is first enacted.
1934	Congress authorized 1.5% of grants to states to be used for planning.
1944	Congress defined the 40,000 mile highway system and increased authorized funding levels to \$500M; diversified federal-aid highway program to 45% for Primary network system; 30% for the Secondary road system; and 25% for Urban extension roads.
1956	Federal-Aid Highway Act of 1956, also known as the National System of Interstate and Defense Highways Act, proposed a 41,000-mile federal system and created the broad program framework we work under today.
1962	The 3C planning process (continuing, comprehensive, and cooperative) is enacted and use of travel forecasting models begins.
1964	Urban Mass Transportation Act authorized capital grants for construction, reconstruction, or acquisition of mass transportation facilities and equipment.
1966	Department of Transportation and National Highway Safety Bureau established; Section 204 of the Demonstration Cities and Metropolitan Development Act creates area-wide planning agencies in all metro areas.
1968	Creates new programs and includes provisions aimed at the environment, historic preservation, public participation, and increasing the use of traffic management.
1970	Urban Mass Transportation Assistance Act provides twelve years of dedicated funding for public transportation.
1973	Allowed flexibility to transfer highway funds for urban mass transportation and return highway funds in exchange for equal general funds for transit.
1974	National Mass Transportation Assistance Act allowed federal funds to be used for transit operating expenses.
1976	Broadened use of construction funding to include the 3R of highways (resurfacing, restoration, and rehabilitation); U.S. DOT begins a road-pricing pilot program.
1978	Surface Transportation Assistance Act was the first law to combine highway, transit, and safety authorizations; authorized bicycle projects, increased funding for bridge repair, and established "Buy America."
1981	Expanded eligibility to a fourth R, reconstruction, and increased federal share to 90%.
1982	Increased gas tax from 5 to 9 cents and set interstate completion date for 1991.

1991	Intermodal Surface Transportation Efficiency Act (ISTEA) authorized \$151 billion over six years. It created a unified surface transportation program with increased flexibility. The completed Interstate system became part of a new, larger “national highway system” and increased the gas tax 5 cents, with 2.5 cents for deficit reduction and 2.5 cents for transportation.
1993	Established a 4.3 cent gas tax increase for deficit reduction.
1995	Shifted 2.5 cents from deficit reduction to transportation.
1998	Transportation Equity Act for the 21st Century (TEA-21) authorized new flexible programs and increased authorized funding to \$198 billion over six years. Shifted 4.3 cents from deficit reduction to transportation.
2005	The Safe, Accessible, Flexible, Efficient Transportation Equity Act – A Legacy for Users (SAFETEA-LU) continued ISTEA-type programs and added new safety programs, and emphasized transportation security.

APPENDIX II

Methodology for Federal Transportation Program Diagnostics

SAFETEA-LU authorized at least 150 individual programs, set-asides within programs, and sub-set-asides within those. The law is divided into eleven titles: I - Federal-Aid Highways; II Highway Safety; III Public Transportation; IV Motor Carrier Safety; V Research; VI - Transportation Planning and Project Delivery; VII – Hazardous Materials Transportation; VIII - Transportation Discretionary Spending Guarantee; IX - Rail Transportation; X – Miscellaneous Provisions; and XI – Highway Reauthorization and Excise Tax Simplification.

In order to assess the most salient features of the individual programs, some of which are duplicative, extremely small, or not authorized for the life of the law, a number of programs were removed from the analysis.

First, Titles VI, VII, VIII, X, and XI of SAFETEA-LU were excluded from the analysis because they do not address programmatic funding levels. Further, individual research programs in Title V were consolidated into a single Title-specific program funding level. The remaining titles, Title I, II, III, IV, and IX, represent the majority of funding authorized through the law, as well as the core elements of the current transportation program.

Second, within the remaining Titles I, II, III, IV, and IX programs were removed from the analysis. Those programs were (1) under \$1 million average annual authorization, or (2) only authorized for one or two years, and/or (3) sub-set-asides within a program set-aside. In Title I, 42 programs were affected and in Title II, 3 programs were removed.

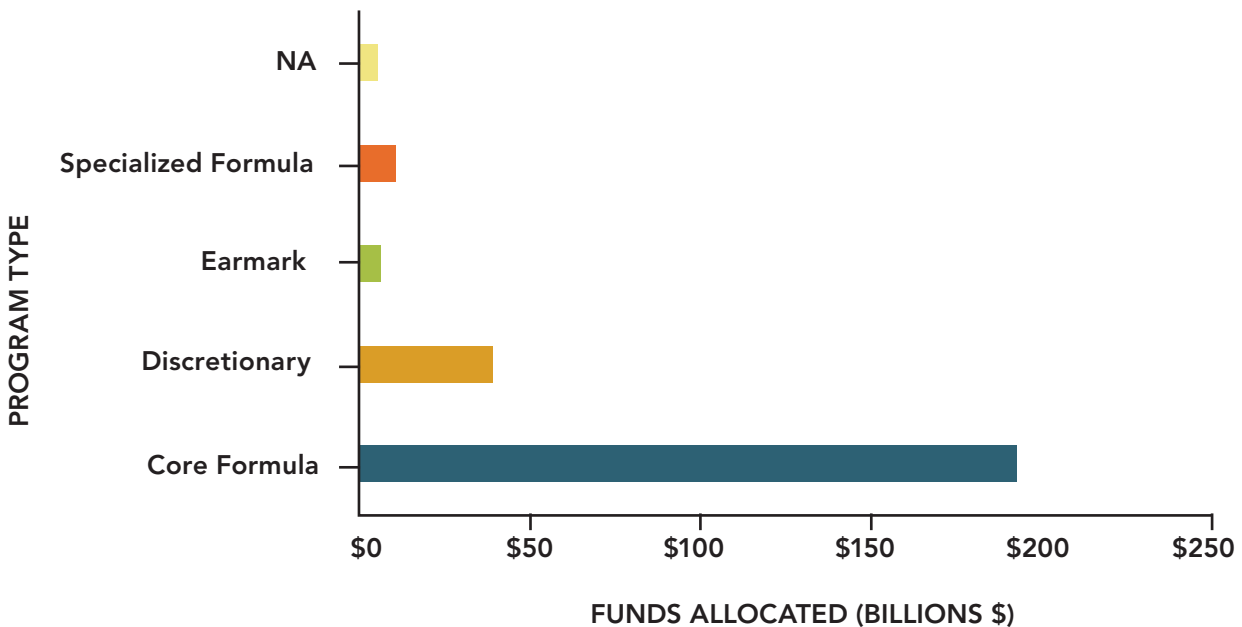
These measures were necessary to reduce the overall number of the programs, eliminate extremely small or specialized funding formulas, and allow for a more meaningful analysis.

As the sheer number of programs and complexity of funding mechanisms grow, eight programs within the transit and highway titles are increasingly—and deceptively—referred to as “core” programs. These “core” formula-driven programs—six within the highway title and two within the transit title—are considered ‘core’ because together, they represent nearly 75% of authorized funding through SAFETEA-LU and are the source of funding for most federally assisted transportation projects.ⁱ

Program	Purpose	Formula
Congestion Mitigation and Air Quality (CMAQ)	Projects and programs to reduce transportation emissions in areas with poor air quality	A weighted ratio of a state’s population in non-attainment areas to the national population in non-attainment areas.
Fixed Guideway Modernization	Projects to modernize or improve existing rail transit systems	A seven-tier formula in the appropriations process that divides cities into Old Area Cities and New Areas.
Highway Bridge Program (HBP)	Projects to improve the condition of highway bridges through replacement, rehabilitation, and systematic preventative maintenance	A complex formula based on characteristics of bridges within each state, including eligibility for rehabilitation or replacement, deck area, and the cost of repairs.
Highways Safety Improvement Program (HSIP)	Projects designed to significantly reduce highway fatalities and serious injuries on public roads	A 1/3 ratio of state federal aid lane miles, vehicle miles traveled, and fatalities to national figures.
Interstate Maintenance (IM)	Projects to resurface, restore, rehabilitate, and reconstruct interstate routes	A 1/3 ratio of state interstate lane miles, vehicle miles traveled, and commercial vehicle contributions to trust fund to national figures.
National Highway System (NHS)	Projects improving roads that are part of the national highway system	A multipart ratio of state principal arterial lane miles, vehicle miles traveled, diesel gallons, non-interstate lane miles, and population to national figures.
Surface Transportation Program (STP)	Projects states and localities may carry out on any federal-aid highway, including bridges, transportation enhancements, transit capital, and bus facility projects	A multipart ratio of state federal aid lane miles, vehicle miles traveled, and estimated state gas tax payments to national figures.
Urbanized Area Formula Program	Planning, design, and construction of bus and rail transit systems and related facilities	Funds distributed by 8 formulas to urbanized areas based on service, ridership, and census data.

Three additional programs are sometimes considered “core” because of their size and/or importance within national transportation policy—and hotly contested in current authorization debates. The Equity Bonus Program, one of the largest federal programs, distributes funding to states through the other core highway programs. Simply put, the way it works is that the individual program formulas determine the initial apportionment amounts provided to each state, and then the equity bonus funding is added to these levels to bring donor states up to their guaranteed rate of return. For FY2008 the funding distributed through this program was almost 25% of total apportionments.ⁱⁱ

Transportation Funds Allocated to States and Regions



Also significant are two transit programs, the New Starts Program and the Bus and Bus-Related Facilities Capital Program. While both are discretionary programs, and while the Bus Program contains mostly earmarks, these programs are also sometimes considered “core” because of their importance to transit systems and, consequently, metropolitan mobility. New Starts funding, 18% of overall authorized funding for transit, is available on a competitive basis for new fixed guideway systems and extensions. Bus Program funds, 9% of authorized funding, are intended to purchase buses and bus-related equipment.

NOTES *i. John W. Fischer et al., “Surface Transportation Reauthorization Legislation in the 111th Congress,” Congressional Research Service, August 26, 2009, www.itsa.org/itsa/files/pdf/ReauthMajorProvisions.pdf.*

ii. Robert S. Kirk, “The Donor-Donee State Issue: Funding Equity in Surface Transportation Reauthorization,” Congressional Research Service, March 19, 2009, http://nepinstitute.org/get/CRS_Reports/CRS_Energy/Oil_and_Other_Energy_Sources/Donor-Donee_State_Issue.pdf.



A large crane is shown in silhouette against a clear blue sky. The crane's lattice structure is prominent, and it is lifting a heavy, dark object. The background shows a dark horizon line, possibly a building or a hill, under a bright sky.

Rebuilding for the Twenty-First Century

In 1916, when the first federal transportation law was enacted, the primary stated goal of federal transportation policy was “getting farmers out of the mud.” Three years later, Captain Dwight D. Eisenhower of the U.S. Army undertook an expedition to test how long it would take a battalion of 280 men to cross America by truck convoy. The answer: 62 days from Fort Meade, Maryland, to San Francisco, which thus led national defense to be added as a second and equally important federal transportation goal.

Today, transportation is tasked with far broader national goals. According to President Barack Obama in his 2011 State of the Union Address,

We need the fastest, most reliable ways to move people, goods, and information. That's how we'll win the future. We've begun rebuilding for the 21st century. We should redouble those efforts. We also need to take responsibility for our deficit and reform our government. We'll make sure this is fully paid for, attract private investment, and pick projects based on what's best for the economy, not what's best for politicians.¹

No doubt, security still remains at the core of the United States' investment in transportation. But the definition of security has broadened from efficiently moving troops and military equipment to a more fundamental focus on advancing economic, energy, and environmental security today. Unfortunately, the federal surface transportation program no longer ensures U.S. security. In fact, in some ways, it is undermining national security—for example, by requiring vast amounts of a singular fuel, oil, to power the country's transportation systems, with a majority of oil being imported from sometimes unreliable suppliers. The current program also jeopardizes the country's fiscal health and does not go far enough to promote its economic growth. Moreover, the billions spent on transportation do not maximize social benefits.

The public is ahead of policymakers on transportation reform. In surveys, respondents who believe that current transportation efforts are inadequate far outnumber those who say their mobility needs are being fully met by 10 to 1.² Now is the moment to capitalize on public opinion and national interests to reform transportation at its core.

A paradigm shift is needed in the way Americans think about transportation, the services they demand from the nation's transportation system, and the investments they make in this system. The country needs to shift its focus from seeking mobility to providing greater access, from increasing the speed of travel to improving the reliability and efficiency of transportation services, and from building singular transportation projects to efficiently managing transportation networks. The national concept of transportation has evolved from a glorification of the "freedom of the open road" to an appreciation of the more fundamental freedom of economic, social, and environmental sustainability. How the nation meets the challenge of the federal transportation program's insolvency will determine its ability to maintain and advance these important freedoms. But who will pay to rebuild for the twenty-first century? Old debates over gasoline taxes and pork-barrel projects must be put aside. America needs an

“insurance policy” to guarantee that its transportation system can meet the needs of a twenty-first-century globalized economy and society, while enabling it to live within the environmental and resource constraints of a twenty-first-century planet.

A Consensus on Transportation Reform

Although Americans may disagree about many issues, there is wide agreement that leaders in Washington should seek common ground on transportation. A 2011 poll found that 79 percent of the public agrees that “in order for the United States to remain the world’s top economic superpower, we need to modernize our transportation infrastructure and keep it up to date.”³ And in the same survey, two in three voters said that improving the nation’s infrastructure is highly important, and that the United States’ current infrastructure system is inadequate.⁴ Few believe that current federal transportation spending practices are efficient and wise, and voters thus would welcome a range of reforms for financing transportation projects. The public views reform in this area as a way to improve the economy, make communities safer, and improve Americans’ quality of life.⁵

Fortunately, though broken, the situation is fixable. (For a diagnostic of the structural problems with the federal transportation program, see chapter 2.) Numerous efforts put forward by think tanks, advocacy groups, transportation experts, two congressionally mandated commissions, and Congress itself provide guidance on how best to reform transportation policy. Together, transportation experts reiterate the need for solvency, an overhaul of transportation funding mechanisms, and wiser investment of federal resources. They also emphasize the need for dedicated and stable revenue sources. Ultimately, the federal transportation program must be transformed from one that lacks purpose and accountability into one that is built on the principles of efficient performance, equitable outcomes, and an enduring return on investment—and can thus be entrusted with additional resources.

Several common goals characterize experts’ guidance on how to reform transportation. Reform calls for a clear national transportation vision, including an explicitly defined role for the federal government in transportation policy. An emphasis on efficient performance and accountability is needed. A systemic and mode-neutral approach to planning is required. And the priorities of energy, economic, and environmental security must be integrated into transportation policy.

FACT

79%

of the American public agrees that the United States must modernize its transportation infrastructure in order to remain the world’s top economic superpower

Redefining the National Program's Intent

An articulated federal purpose is necessary to move the U.S. transportation system forward. Recommendations for a national vision are coupled with a call for greater accountability to achieve higher performance. Guideposts for transportation decisionmaking should include solvent funding, rational financing, program restructuring, and alignment with security interests.

“America requires a new vision for transportation. While our needs have changed in the last 50 years, our national models for selecting, prioritizing, coordinating, and funding transportation investments have not.”

—Miller Center of Public Affairs⁶

Establishing Solvent Funding

Transportation needs new, stable, reliable, and adequate sources of revenue. New revenue streams must end the periodic insolvency of the Highway Trust Fund that requires periodic transfers from the general fund and imposes further stress on the federal budget. Solvency means providing guarantees for meeting future transportation needs under a variety of economic and geopolitical conditions. This will require funding the transportation system on a pay-as-you-go basis. The nation can no longer rely exclusively on the idea of “user pays, user benefits.” In reality, everybody uses transportation, and everyone suffers when the system suffers from periodic shocks, whether from spikes in fuel prices or from catastrophes such as the terrorist attacks of September 11, 2001. Although the country needs to move from a system in which access is unregulated and free, causing congestion and periodic gridlock, to a system whose users pay the cost of the capacity actually used, this will not be enough to ensure the system’s long-term fiscal health. Other system beneficiaries, including all who gain from the increased global commerce and social exchanges enabled by transportation—as well as those who profit directly from building, fueling, and operating the system—are eligible parts of the funding equation.

Rationalizing Financing

Multiyear commitments for transportation projects make systematic financing crucial. Investments must meet infrastructure needs while also providing measurable and sustained economic and social benefits. Potential financing models already exist, such as Build America Bonds for short-term, local projects, and the Transportation Infrastructure Finance and Innovation Act, which has assisted urban areas with capital improvements of mass transit systems. Another model is the Transportation Investment Generating Economic Recovery (TIGER) program, a recent competitive



grant initiative whereby projects were selected for funding based on a cost-benefit analysis. (See later in the chapter for more on TIGER.) Consideration should be given to further structuring transportation financing around competing modes. High-speed rail, for example, provides a potential alternative to regional air travel, which is financed from the Airport and Airway Trust Fund.⁷

Restructuring Core Programs

The federal transportation bureaucracy has propagated itself to the point where it is no longer workable. There are currently more than 100 distinct subprograms in the federal transportation program. All experts call for restructuring core programs, and most call for consolidation and fewer, more manageable program areas. At the same time, a balance must be struck between overcentralization and a complete lack of coordination. The federal government must strategically manage transportation programs while providing some flexibility for experimentation, innovation, and the accommodation of unique local needs.

Integrating Energy, Economic, and Environmental Security in Investment Decisionmaking

The current U.S. transportation system hinges on a narrow band of energy, economic, and environmental conditions that endanger its long-term functionality. For instance, American mobility is currently premised on

“With the clear unsustainability and performance issues of the current program, it is an opportune time for Congress to better define the federal role in transportation and improve the progress toward specific, nationally defined outcomes.”

*—U.S. Government
Accountability Office⁸*

ample supplies of oil imports, which can easily be hampered by local and global disruptions. Future transportation investments must reduce these types of security risks. Outside the densest urban areas, U.S. land use is not location efficient for households and firms, and thus generates inefficient vehicle miles traveled. Likewise, U.S. transportation is besieged by the environmental damage it causes. Air pollution, noise, climate change, and oil spills are but a few of the consequences that harm health and well-being. The transportation system must be evaluated within a much broader social and economic context in order to deliver both socially and economically in an increasingly competitive global marketplace.

Moving the Transportation System into the Twenty-First Century

America is at a critical crossroads. The U.S. transportation system is largely built out, yet it needs to be refurbished and updated to meet unprecedented levels of global mobility in the twenty-first century. Significant reinvestment is called for at a time when the national economy is troubled and the national debt is expanding. Future generations should not be saddled with a deteriorated system that lacks mobility choice and adequate funds for upgrades, upkeep, and innovation.

As a hedge to guarantee a better transportation future, each investment dollar must count. Transportation projects must deliver to the nation's bottom line as well as broader societal goals. To determine which projects deserve limited public dollars, this report advances three overlapping principles to which a solvent transportation program must subscribe—competitiveness, innovation, and energy independence—and that thus form the basis for establishing national transportation system goals.

Competitiveness

The U.S. transportation system must support and enhance U.S. global competitiveness. The U.S. trade deficit increased to \$500 billion in 2010. The Obama administration has called for policies that would double U.S. exports to reduce the trade deficit that has endured for two decades, while also cutting present levels of imported oil by one-third by 2025. In January 2011, around 75 percent of the U.S. trade deficit was due to oil imports¹⁰ (see figure 3.1). For much of modern history, the United States was a major

“Since substantial completion of the Interstate Highway System (late 1980s), the country has lacked a clear, comprehensive, well-articulated and widely understood strategic vision to guide transportation policy-making at the national level.”

—*National Surface Transportation Policy and Revenue Study Commission*⁹

FIGURE 3.1

Oil's Share of the U.S. Trade Deficit, 1998-2011

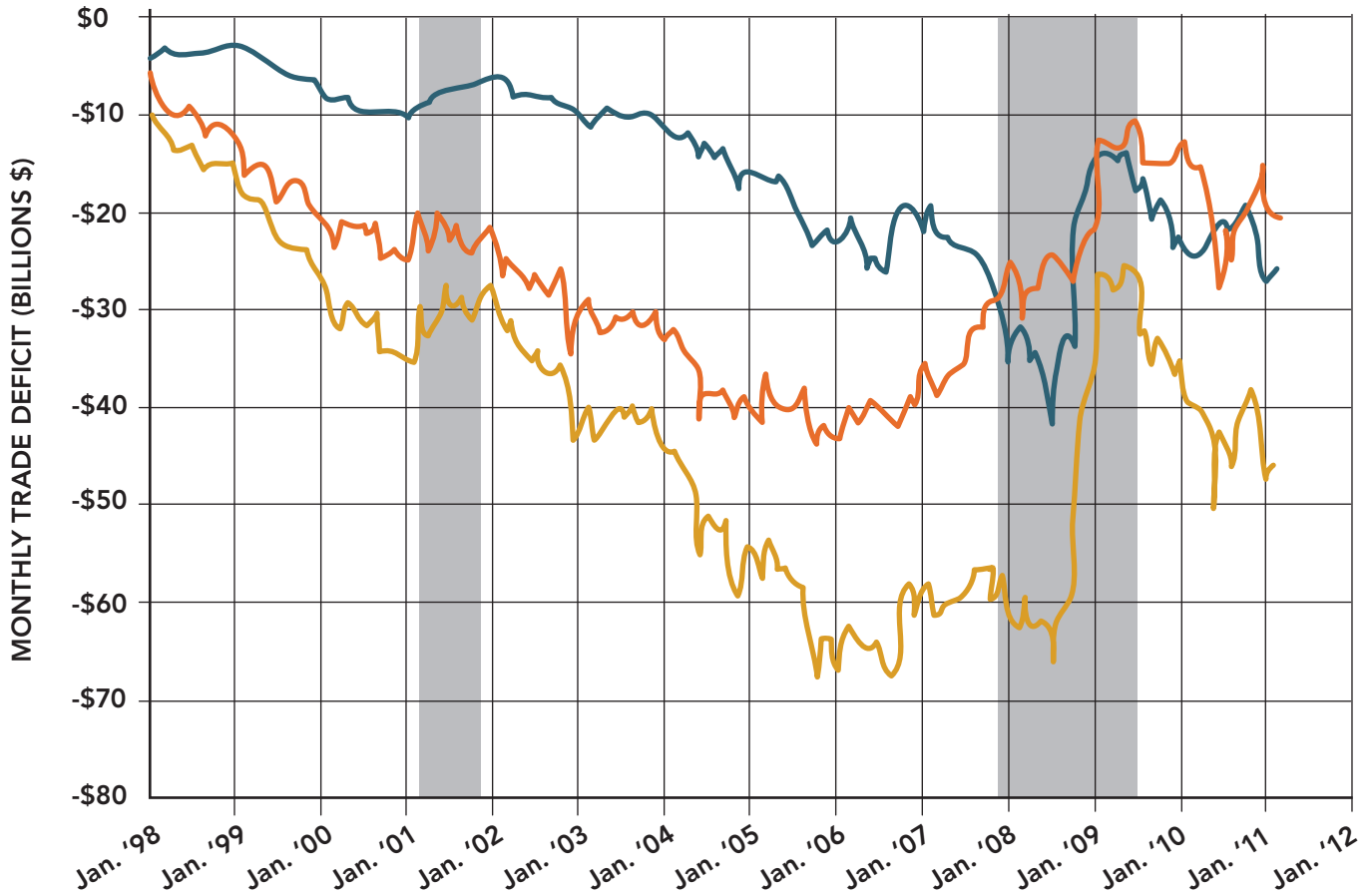


FIGURE 3.1

SOURCE: Calculated Risk, www.calculatedriskblog.com/2011/04/trade-deficit-decreased-in-february-to.html, citing U.S. Department of Commerce data, April 12, 2011.



increase,¹² and America will add 100 million people faster than China.¹³ Yet the United States spends 50 percent less on infrastructure as a proportion of gross domestic product (GDP) than it did in 1960, and its small share—2 percent of GDP—is less than those of developing nations such as China (9 to 12 percent) and more compact, developed Europe (5 percent).¹⁴ Investments in urban areas are also critical. America’s long-term prosperity is dominated by its 100 largest metropolitan regions, which are home to two-thirds of its people and generate 74 percent of its GDP.¹⁵ Of these 100 regions, the most populous five generate 23 percent of GDP.¹⁶

Innovation

The United States has historically taken a leading role in global innovation. Its future transportation investments should continue this tradition and embrace innovation in three ways. First, transportation should support the context in which innovation flourishes. This can be expressed spatially, for example, through agglomeration, whereby firms locate close together to reap benefits such as supply-chain efficiencies and knowledge spillovers.¹⁷ Second, future infrastructure must enhance operating efficiencies through technological and system innovations.¹⁸ And third, transportation must be integrated into innovation in other sectors, such as information technology and Internet social networking.¹⁹

Productivity and innovation are mutually reinforcing; high levels of one yield high levels of the other. These areas have common attributes, including a comparatively high density and good infrastructure for mobility and information sharing.²⁰ Thus, it is not surprising that the highest number of patents—a quantifiable benchmark for innovation—has been registered in places with relatively compact land use supported by multimodal transportation systems (see figure 3.2).²¹

Innovation within the transportation system can bring operational efficiencies and other co-benefits. Advances entail technological innovation as well as innovative transportation policies. The Netherlands and Denmark, for example, are instituting pay-as-you-go automobile transportation with pricing according to vehicle miles traveled and excise taxes. These funding sources are coupled with (and underwrite) context-sensitive urban design that maximizes public benefits and efficiency.²² China has poured billions into green transportation—high-speed rail, an electric car system, bus rapid transit, and other transportation innovations—in response to growing frustration over congestion and air pollution.²³ And for the past two decades, Latin America has invested significant sums in bus rapid transit and has deployed policy tools to ensure that development patterns support mass transit investments.²⁴ These examples show how productivity and innovation are synergistic drivers of sustainable development.

FACT

\$391 BILLION

amount of 2010 import costs tied directly to transportation

Energy Independence

Transportation innovation can relieve America's dependence on oil. The current U.S. transportation system accounts for 70 percent of the nation's oil consumption.²⁵ Every president since Richard Nixon has focused national concern on excessive reliance on oil. Although there is a similar reliance in other countries, nowhere in the world is this dependence more evident than in the United States, where there are more registered vehicles than drivers licensed to drive them.²⁶

Breaking the stranglehold that the automobile–oil nexus has on the U.S. transportation sector will not be easy. It will take a concerted push, wise investments in vehicle electrification, public mass transit, new mobility options, more compact development, and greater operational efficiencies throughout the existing transportation system.

The link between transportation and oil dependence does not end with vehicle fuel use. Department of Commerce data show that five of the top eight import categories that drive the U.S. trade imbalance are related to the transportation sector and, most significantly, to automobile-based transportation. With \$391 billion in 2010 import costs directly tied to transportation (this \$391 billion total is disaggregated in table 3.1), it becomes evident that America's mobility is a powerful lever whose future direction will help determine success or failure in creating a more sustainable, competitive, and export-driven U.S. economy.

Considering Future Stakeholders

Investments in America's transportation infrastructure must serve the needs of tomorrow's citizens, anticipating the mobility preferences of future stakeholders. But who are these future stakeholders?²⁷

More than 80 percent of the U.S. population now lives in metropolitan areas of 50,000 or more, and the rate of population growth between 2000 and 2009 in metropolitan areas—10.4 percent—easily outpaced that of “micropolitan” or rural areas.²⁸ Individuals from 21 to 30 years of age represent the second-largest age group in the country. They are set to expand their role in the U.S. housing market and broader economy significantly during the coming decades. These so-called Millennials have been shown to prefer walking to driving and have less interest in owning a car than previous generations. Indeed, 77 percent of Millennials plan to live in dense urban environments.²⁹

TABLE 3.1

U.S. Transportation-Related Imports, by Value, 2010

Imported Good	Value (billions of dollars)	Percentage of Total Imports
Crude oil	197	10.4
Small to midsize conventional-engine cars	58	3.1
Bigger conventional-engine cars and trucks	55	2.9
Refined products (e.g., ultra-low-sulfur diesel and lubricants)	53	2.8
Refined products from lighter crude oil (e.g., gasoline)	28	1.5

Americans 65 and older are the fastest-growing demographic segment in the United States. By 2050, one in five Americans will fall into this category.³⁰ Considering that more than 20 percent of seniors over the age of 65 do not drive and must depend upon alternative transportation options, it will be necessary to expand nonautomobile mobility. Today's lack of transportation options forces half of nondrivers age 65 and older to stay home on any given day, limiting their access to medical care, economic activity, and social enrichment.³¹ The demographic shifts of future stakeholders suggest that there should be fewer investments in new highway capacity and more investments in urban transportation modes that provide high-volume, space- and energy-efficient mobility, such as public mass transit, ultralight neighborhood electric vehicles, cycling, and walking.

This is not to say that rural regions should not be supported. But instead of spreading transportation dollars evenly across all geographic regions, funding should be distributed according to the demonstrated transportation needs that fit shifting American living patterns.

Getting Specific: Strategies for the New Federal Transportation Program

Throughout the nation, transportation professionals are increasingly collaborating on strategies to improve the U.S. transportation system, marrying reform goals and vision with practice. This entails a greater emphasis on preserving the existing system, taking stock of costs and benefits in making new investment decisions, establishing pay-as-you-go services,

TABLE 3.1

SOURCE: U.S. Department of Commerce data published in February 2011, as reported in "Who and What Is the US Trading Internationally," *Wall Street Journal*, February 11, 2011, <http://blogs.wsj.com/economics/2011/02/11/where-and-what-is-us-trading-overseas>.

employing information technologies for improved system operations, and emphasizing comprehensive planning and the integration of land use. It is useful to discuss each strategy here briefly.

Putting More Emphasis on Preserving the Existing System

The era of massive investments by the federal government to build an expansive national transportation infrastructure is winding down, and a new era focused on preservation and strategic system improvements is emerging. This emphasis on maintenance and integration is sensible. Making capital investments on an entirely new transportation system would be geographically constrained and generally unaffordable, given the United States' highly developed environment. Further, the cost of maintaining transportation assets becomes dramatically more expensive when upkeep is postponed.

Analyzing Costs and Benefits When Making New Investment Decisions

With funds in short supply and resources scarce, greater reliance on analytical tools is needed to guide infrastructure investment decisions. Assessing benefits and costs is critical in determining whether certain transportation investments will grow the economy, improve productivity, and support national goals. (See the appendix to this chapter for a discussion of different analytical tools.) These evaluations have been used in the past, but not in any systematic way. But efforts are now under way to refine and integrate them further to prioritize investments more effectively.³² It is important to note that although economic analyses are currently the best tools for explaining the effects of future transportation projects, they are imperfect.³³ It often takes a combination of types of these analyses to illuminate how projects compare with one another. Greater standardization in the quantification and methodology used to evaluate the economic factors associated with different transportation investment options would further facilitate economic analysis.

FACT

23rd

2010 global ranking of the United States
for quality of overall infrastructure by
the World Economic Forum

Ensuring Solvency Through Transportation Pricing

Dissemination of rational pricing information across transportation modes is arguably the best type of information to inform the market.³⁴ Balancing supply with demand is key. For instance, with respect to auto-



mobile use, meeting high volumes with higher prices will reduce congestion, increase mass transit ridership, limit sprawl, and reduce oil dependence. Transportation activities that damage the environment or waste energy and incur other hidden costs vis-à-vis the system should be priced accordingly. Revenue generated through pricing in turn ensures stable funding for transportation investment. Pricing also lessens U.S. dependence on oil in the short term. Wild price fluctuations, both high and low, confound markets. The windfall profits doled out to oil companies can be used to cushion consumers.

Designing Technology-Savvy Transport Systems

The many innovations of the digital age can be deployed throughout the transportation system to reap greater operational efficiency. For example, mass transit services must utilize and report real-time information about arrivals, destinations, and service interruptions to make service user-friendly. Traffic levels on expressways can be relayed in real time to commuters, who can then delay their trips by a few minutes so as not to compete with rush-hour congestion. Cities have centralized traffic information so that they can optimize traffic flow by tweaking the signal timing at key bottleneck intersections. Information technology can seamlessly assign prices for services rendered or more efficiently connect travel demand to supply. Moreover, fleet operators can manage and streamline operations with web-based services that do not require additional information technology infrastructure.³⁵ And social networking and online video meeting sites can help obviate the need for travel altogether.

Emphasizing Comprehensive Planning and the Integration of Land Uses

Planning entails more than setting bricks, pouring asphalt, and laying tracks. The relationships between the locations of things drive demand for

transportation. Thus, incoherent and piecemeal planning results in ad-hoc land uses and can unnecessarily drive up vehicle miles traveled, contribute to congestion, and waste time and energy.³⁶ For businesses, governments can zone land uses and build transportation infrastructure so that the co-location of factories, suppliers, and service providers is possible. The German government, for example, has incentivized co-location, which has resulted in proximity between the auto supply chains for Mercedes and Audi, and environmentally sustainable ports along with intermodal freight handling in Hamburg.³⁷ Transit-oriented development in the United States has combined both business and household needs to maximize transportation infrastructure and potential land uses for greatest economic benefit.

Removing Obstacles

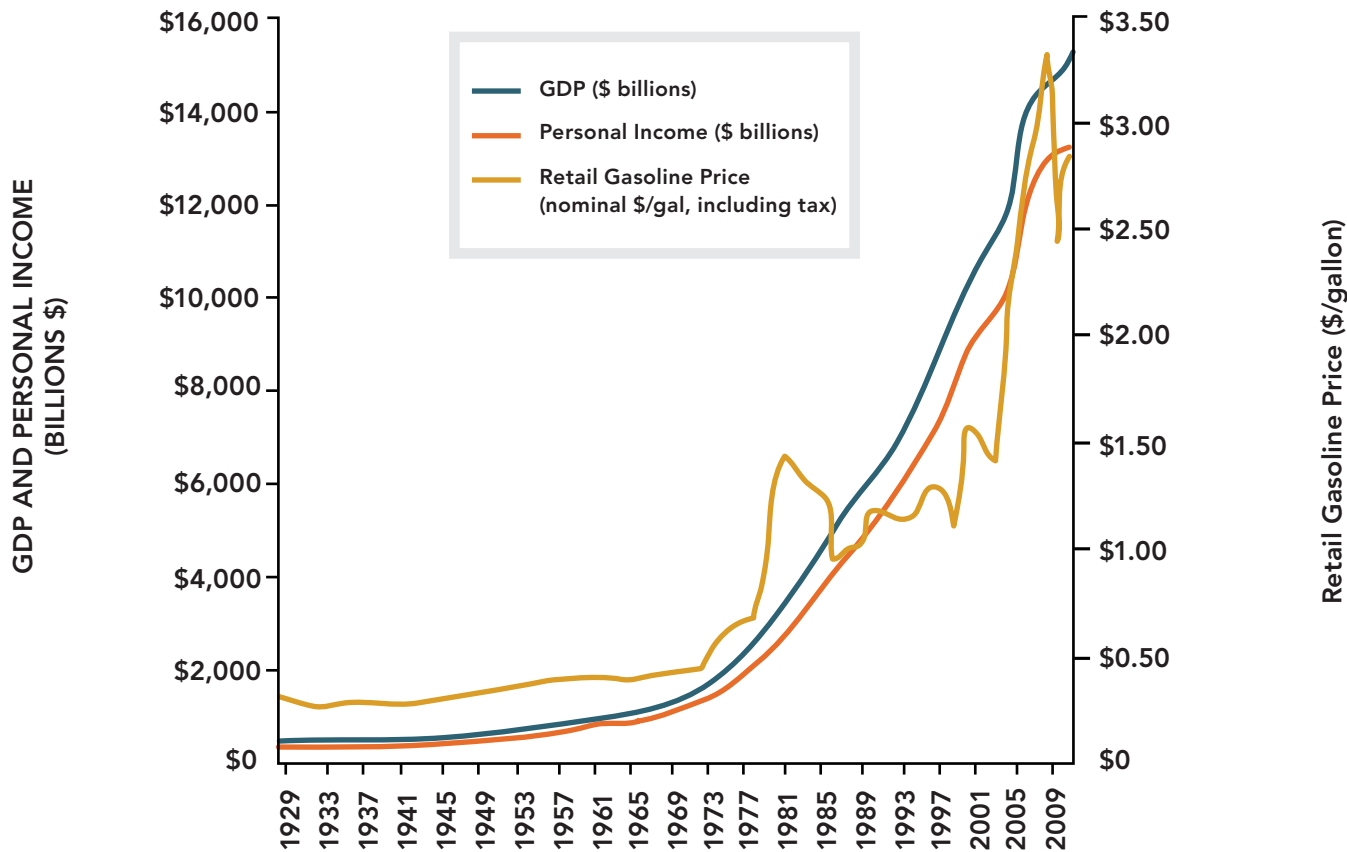
The largest obstacle to transportation reform continues to be finding the political will to implement a strong funding mechanism. In the absence of a politically feasible new proposal for funding surface transportation, there is little appetite in Congress for pursuing a new authorization bill, and thus there are limited reform opportunities.

Chapter 5 provides a proposal for ensuring transportation solvency through new pricing mechanisms. Historically, the United States has funded transportation through fuel taxes. Although the current fuel tax rate generates insufficient revenues to support transportation program solvency, there are ways to correct this, especially because the present situation is untenable. Borrowing from general funds to pay for U.S. mobility is politically challenging under any circumstances, but with the dangerously mounting national debt, it should be unthinkable. Still, proposals for additional sources of revenue have not been forthcoming. There has been no fuel tax increase with the proceeds devoted to transportation since 1982; the last two increases were linked to deficit reduction. In spite of the fiscal situation, there have been few political champions for fuel tax increases.

Transportation taxes are not popular. Polls show that more than two-thirds of Americans find it unacceptable to increase the federal gasoline tax and that a majority of 58 percent also opposes replacing the gas tax with a mileage fee.³⁸ Nevertheless, an equivalent majority of voters believes that the U.S. transportation infrastructure must be improved.³⁹ The fact that Americans demand services and do not want to pay for them may not be surprising, but it must be reconciled.

FIGURE 3.3

Gasoline Price Versus Productivity and Income, 1929–2010



The truth is that higher gasoline prices have not historically dampened U.S. productivity. Personal incomes have not been economically burdened when gas prices have risen. For instance, between 1929 and 2010, both GDP and personal income have risen exponentially. Gas prices have also risen, albeit with some fluctuations along the way (see figure 3.3). Recent evidence suggests that the American economy is even better prepared to manage higher fuel costs.⁴⁰ Consumers and businesses have learned lessons from past oil shocks. Motorists have, to some extent, given up gas-guzzling sport utility vehicles, automakers are selling more fuel-efficient cars than five years ago, and truckers are passing on higher costs.

FIGURE 3.3

SOURCE: U.S. Energy Information Agency, January 2011, www.eia.doe.gov/oog/info/gdu/gasdiesel.asp.

Instead of proposing higher taxes and fees for services, perhaps it is better to frame transportation funding in terms of an insurance policy. Transportation brings many benefits, as discussed in chapter 4. And future economic, energy, and environmental security are insurance worth having.

Beyond transportation pricing, there are also other obstacles to transportation reform. The land-use planning process is opaque, difficult to engage, and subject to “NIMBYism.” (“NIMBY,” short for “not in my back yard,” is a documented phenomenon in planning efforts whereby people will support changes in the built environment as long as they do not happen close to their homes.) Proliferating information technologies and data sources to improve system operations raise concerns about real-time information and privacy. Identifying and applying accurate project-assessment tools and model inputs remain difficult. And there is disagreement on what are the best transportation investments.

But none of these barriers is as formidable as simple resistance to change. Road builders and mass transit providers are not necessarily opposed to reform. They are just more focused on continuing the flow of revenues to their stakeholders than on improving federal investment returns or solving deficit problems. Likewise, the states remain rooted in outdated arrangements, and metropolitan areas have limited input. It is up to the federal government to take the reins and help the nation overcome the obstacles to restoring transportation solvency.

Searching for Signs of Progress

One promising example of sound transportation reform is the \$1.5 billion Transportation Investment Generating Economic Recovery (TIGER) program, which is part of the American Recovery and Reinvestment Act (ARRA), a stimulus initiative. TIGER provides discretionary grants through the U.S. Department of Transportation and requires a cost-benefit analysis. This is the first time that such an analysis has been made a condition for transportation funding. TIGER grants awarded over \$1.2 billion throughout the country to fund projects that addressed travel and economic issues at the same time. This hallmark TIGER program, as a multi-modal and multipurpose competitive initiative, could be a model for the types of incentive grants that will encourage state and local investment and a broader consideration of transportation goals.

TABLE 3.2

**Carnegie Endowment
Reform Recommendation**

White House Transportation Proposal

Establish solvent funding	<p>Transforms Highway Trust Fund into a Transportation Trust Fund that funds highways as well as additional safety and transit programs, passenger rail programs, and a National Infrastructure Bank. Funding will be set in reauthorization process. Appropriators will set annual obligation limits on total spending amounts but will not be able to make year-to-year programmatic changes.</p> <p>Establishes “fix it first” approach to highways and public transit investments.</p>
Rationalize financing	<p>Sets aside \$30 billion investment to establish a National Infrastructure Bank to provide loans and grants to support individual projects that are of “national significance.”</p>
Restructure core programs	<p>Consolidates 55 highway programs into five. States and localities are given greater authority to direct funding toward high-priority projects but must establish and meet performance targets and adopt cost/benefit analysis of major projects before they are initiated.</p> <p>Creates new livability program to promote local projects like multimodal transportation hubs and streets that accommodate pedestrian, cyclists, and transit access.</p>
Integrate climate and energy concerns	<p>Creates competitive grant program to improve coordination between planning entities and increase ability to deliver sound, data-driven, and collaboratively developed transportation plans.</p> <p>Doubles budget for transit programs for existing capacity and capacity expansion.</p> <p>Creates “Transportation Leadership Awards” to incentivize state and local partners to adopt critical reforms in safety, livability, and demand management.</p>

Building on ARRA's transportation efforts, the Obama administration's budget proposal for fiscal year 2012 reflects many transportation program reform recommendations. For example: (1) The Highway Trust Fund would be transformed into a transportation trust fund, reflecting a "mode neutral" role for federal transportation assistance; (2) deferred maintenance, a high-expense proposition that unduly taxes future generations unfairly, would be replaced by a fix-it-first approach; (3) a National Infrastructure Bank would be established to provide loans to nationally significant transportation projects; (4) the present 108 separate surface transportation programs would be significantly consolidated; and (5) states and localities would be given authority to directly fund high-priority projects. (See table 3.2 for the details.) This proposal is the start of a conversation that could, if continued through vigorous congressional debate, result in a transportation reform bill with sufficiently broad, bipartisan support to achieve passage.

Conclusion

A nation's transportation system is a major catalyst for its economic growth. During times of limited resources, as witnessed in the most recent global financial and economic crisis, spending should be optimized to reap the largest returns from infrastructure investments. At a minimum, the system should be solvent. Borrowing from general revenues and future generations should be avoided. Changes to the system should ensure future economic growth, recognize demographic and geographic shifts, advance environmental and energy security, and embrace and support innovation. Tweaks to the United States' mature system need to be applied sensitively, and trade-offs need to be better understood through the use of economic analysis.

The federal transportation program must be restructured so that these larger goals are met. Ascertaining sustainable program funding is paramount. Without new revenue to meet transportation infrastructure needs, program restructuring cannot happen. America needs to ensure that its transportation system has adequate revenues, promotes balanced uses, and is aligned with national goals. Systematic pricing is required for the system to benefit the public interest in a responsive, trustworthy, and cost-effective manner.



Type of Economic Analysis

What Does It Measure

Cost-benefit analysis

Local or regional benefits of varying transportation projects to evaluate the allocation of public resources.

Private economic development benefits

Benefits only. Based on microeconomic indicators such as property values, retail receipts, tax receipts, tenancy rates, and short-term job creation. Often included in required environmental impact reporting.

Agglomeration benefits

Potential economic benefits from proximity and types of transactions (hard and soft) of firms and households within a specific location.

Macroeconomic benefits

How infrastructure projects contribute to national economic health.

Social return on investment

Method for measuring extra financial value (i.e., environmental and social value not currently reflected in conventional financial accounts) relative to resources invested.

Distributional equity analysis

Determination of how a particular policy or investment impacts different economic segments of society, with a particular interest in at-risk segments of the population.

NOTE: This table reflects some of the most common economic analyses for transportation projects from a literature review of reports. It includes economic analytical methods from U.S., UK, and Australian regional as well as peer-reviewed journal articles. However, it is not a comprehensive list of all of the types of economic analysis available.

Utility/Application

Evaluates project against project. Cost-benefit ratio derived by assessing sum total of all the benefits against all the costs. Any authority can define types of benefits and costs—but analysis is only valuable if the factors remain the same for projects that are being compared to one another. Note that localities, regions, states, and nations have varying cost-benefit scenarios—so comparisons are difficult across different jurisdictions. Issues of the time value of money confound cost-benefit analyses, as different discount rates change analytical outcomes. This is a standard method used by government agencies in assessing regulatory decisionmaking.

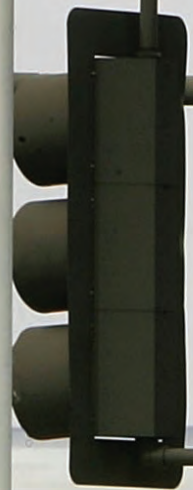
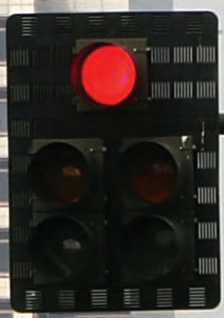
Usually the strongest form of this analysis is with a regression model—after a project is completed. The figures from the regression model then form the foundation for forecasts of economic development benefits for future projects.

At the moment, the phenomenon of agglomeration economies is mostly qualitative and accepted by academics, but econometric models are still in development. Agglomeration benefits are difficult to quantify due to (1) the many factors that define a specific location, (2) lack of agreement in what common factors are across locations, and (3) lack of standards for quantifying those factors.

Employs broadest economic indicators to assess value of infrastructure projects. These include real gross domestic product, unemployment rate, rate of inflation, interest rate, level of stock market, and exchange rate. Though these indicators are the backbone of international comparisons, they are challenging because they do not account for regional differences (entire U.S. data are counted) that are an important factor in infrastructure investment. Also, it does not account for dislocation effects, so while one region might benefit from one project, another region might lose.

Some benefits are important to stakeholders but cannot be easily monetized. An analysis of social return on investment should not be restricted to one number, but seen as a framework for exploring an organization's social impact, in which monetization plays an important but not exclusive role.

Citizens are disaggregated into income and/or expenditure groupings to determine how policy change affects them. This analysis is used to identify opportunities to compensate certain strata to maintain equity. A full distributional analysis is very complicated; it requires detailed performance information over time on local, regional, and national scales, since cost and benefits of large projects are dispersed. Even if such information is available, as time goes on it is increasingly difficult to isolate the effects of a particular project from its broader context.



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Pricing Transportation for Energy, Economic, and Environmental Security

If the U.S. transportation system were strategically managed, it could significantly enhance the nation's economic, energy, and environmental security. A substantial body of research suggests that transportation can have a positive impact across these areas. According to the U.S. Treasury and the Council of Economic Advisers,

Well-designed infrastructure investments can raise economic growth, productivity, and land values, while also providing significant positive spillovers to areas such as economic development, energy efficiency, public health and manufacturing.¹

Yet, economic, energy, and environmental goals are impeded by the codependent relationship between oil and the U.S. transportation system: Transportation needs oil to operate, and oil needs transportation to maintain its global dominance in energy markets. This codependence comes at high direct, indirect, and opportunity costs. Transportation is responsible for nearly three-quarters of U.S. oil consumption. Lack of other fuel choices impedes the development of mobility options due to the near-monopolization of fueling stations by oil companies. Electrification of cars through battery technology and of the transportation grid through fast-charging stations or fully electrified systems will take enormous amounts of time and money. Cars using specialized fuels and natural gas are not widely available, and biofuels require pumps and vehicles to be altered to accommodate various types of ethanol and biofuel blends. The internal combustion engine itself is far from reaching its point of maximum efficiency and will be a major competitor to alternative fuels and power trains throughout the twenty-first century. Oil has a high energy density, is not volatile, and is easily transported and relatively ubiquitous. Thus, there is no quick fix for oil dependence.

Still, the case for diversification away from oil is compelling. American mobility is still held hostage to unpredictable world oil price spikes and geopolitical instability.² Further, oil dependence devours economic and defense resources that could be better expended elsewhere. Oil and auto imports weigh heavily on the U.S. economy, and a significant portion of America's large military budget is devoted to securing global oil supply lines. U.S. transportation drives climate disruption and causes environmental degradation.

These costs of oil dependence are not obvious because they are usually hidden in the total price tag or misallocated to other parts of the economy. Thus, better marginal cost pricing of transportation is essential. Pricing would serve to accurately reflect full transportation costs, internalizing social effects, moderating demands, and modifying supplies. Pricing conveys important information that helps consumers and firms make educated decisions. To reap the benefits of positive spillovers, transportation must be priced right.

Given the tremendous potential for transportation to deliver benefits (or rack up unnecessary costs), both domestically and globally, it is essential that the United States take the step of pricing transportation. There are significant public benefits that accrue from pricing transportation. Pricing can also positively influence transportation reform. These benefits break



down into two categories: (1) direct energy and environmental benefits and; (2) indirect economic and other co-benefits.

Continued underpricing of transportation energy and services places the economy, and the well-being of the nation, at risk. It will not be easy to make the wholesale changes necessary to price transportation accurately. Still, the United States' security is worth the price.

Pricing for Transportation Reform

Americans pay for transportation—especially roads—mostly through a disjointed set of flat taxes and fees that do not reflect the true cost of using the network. (See chapter 2 for a discussion of how surface transportation is currently funded.)³ Consumers are confronted with prices that do not impart information about the relative benefits and costs of system use. This leads to inefficient decisionmaking with respect to travel choices, which in turn begets inefficient transportation investments. Significant costs are hidden, exacting a price indirectly on system users and the general public.

Charging a more accurate price for a traveler's use of transportation infrastructure can help managers operate the system more efficiently, improve overall system capacity (thus reducing the need for expensive new capital investment), and lower system externalities. Setting a variable price—based on factors such as time, place, and vehicle emissions—imparts systemwide information, yielding more refined travel choices. Over time, this shift in travel decisionmaking brought about by pricing would help federal, state, and local governments better select, design, and manage the transportation system.

FACT

38%

decline in the buying power of the federal gas tax since 1993—the last time the gas tax was raised

History of Transportation Pricing

Transportation pricing comes in many forms. The most conventional are fuel taxes on gasoline and diesel. These taxes were first established at the federal level in 1932 under a revenue act to support general relief during the Great Depression, and gradually became more directly focused on funding the creation of a national system of roads and highways. The size of the federal gas tax has gradually increased but still lags significantly behind the average state gas tax of 26 cents per gallon (see table 4.1). Since 1956, Congress has counted on ever-increasing gas tax revenues generated from ever-increasing traffic volumes to keep up with expenditures. However, these efforts have fallen short. Federal gas taxes have been increased five times, with the resulting revenues directed at various times toward transportation, deficit reduction, and other specific uses.⁴

TABLE 4.1
History of U.S. Gasoline Taxes

Year or Period	Increase	Purpose	Tax Rate per Gallon
1932		General funds	1 cent
1956	+ 3 cents	Transportation Trust Fund	4 cents
1982–1984	+ 6 cents	Highway Trust Fund + Mass Transit Account	9 cents (with 1 cent going to transit and 8 cents to highways)
1986	+ 0.1 cents	+ Leaky Underground Storage Tank Trust Fund	9.1 cents (with 0.1 cents going to the superfund account)
1990	+ 5 cents	+ General fund	14.1 cents (with 2.5 cents going to the general fund and 1.5 cents to transit)
1993	+ 4.3 cents	+ General fund	18.4 cents (with 4.3 cents going to the general fund)
1995	No change	– General fund	(2.5 cents previously to general fund moved to highways)
1998	No change	– General fund	(4.3 cents previously to general fund moved to highways)
Since 1998			15.44 cents for highway 2.86 for transit 0.1 cents for leaky underground storage tanks (LUST)

TABLE 4.2

History of Other Motor Fuel Taxes (cents per gallon)

Year	Diesel Fuel	Special Fuels
1951	2	2
1956	3	3
1959	4	4
1983	9	4
1984	15	4
1987	15.1	4
1990	20.1	14
1993	24.4	18.3
1996	24.3	18.3
1997	24.4	13.6
2010	24.4	14

As gas tax receipts have risen over time, so have transportation funds authorized by Congress. In recent years, however, motorists have started driving fewer miles, have purchased more fuel-efficient cars, and have reduced their consumption of gasoline overall. As a result, the monies generated from gas taxes have fallen below authorized levels. Since 1993, the buying power of the federal gas tax has declined approximately 38 percent, with an effective present (2011) purchasing power of 11 cents in 1993 prices.⁵

In addition to taxing gasoline, taxes have historically been levied on diesel fuels, principally for trucks. Special fuels used for transportation include liquefied petroleum gases (propane and butane), naptha, and other liquid fuels (except gasoline, gasohol, and diesel).⁶ Propane is the most commonly used special fuel used in transportation. Diesel and special fuels used for farming, by nonprofit organizations, and by state and local governments are not taxed or, if a tax is paid, it is fully refundable (table 4.2).

Future Transportation Pricing

Conventional fuel taxes have many drawbacks. Perhaps the biggest hurdle is the decided lack of political will to increase them, or even to index them to inflation so they retain their purchasing power. The limitations of conventional fuel taxes have invited extensive studies of new transportation pricing strategies.

TABLE 4.1

SOURCE: Source: Federal Highway Administration, *Financing Federal Aid Highways*, Publication FHWA-PL-07-017 (Washington, D.C.: U.S. Government Printing Office, 2007).

TABLE 4.2

SOURCE: Federal Highway Administration, "Highway Statistics," www.fhwa.dot.gov/ohim/hs00/fe101a.htm.

The evidence from these studies suggests that new ways of charging user fees for transportation may do a more effective job than gas taxes. For example, a recent study found that mileage-based and use-based pricing (including vehicle-miles-traveled fees, pay-as-you-drive insurance, and tolling) may be ten times more effective at incentivizing more efficient auto use than gas taxes.⁷

When it comes to transportation pricing, all levels and mechanisms are not equally effective. Small prices may raise ample revenues, but they tend to be lost in market fluctuations and are weak at communicating costs to users. Likewise, the more direct the connection between price and demand, the more effective the behavioral response. Gas taxes, despite their familiarity, are thought to be less effective than mileage-based charges at incentivizing more efficient auto use.

America would significantly benefit from a transportation pricing policy designed specifically to provide revenue stability for a fully funded and solvent transportation program that ensures national security and prosperity. Revenues directed toward sound transportation investments can improve the public health of Americans, expand mobility options, build thriving communities, reduce the nation's dependence on foreign oil, protect the environment, create jobs, and ensure global competitiveness.⁸ A portion of the revenues raised can be used to protect the most vulnerable populations. Economic gains can be realized by reallocating transportation resources through pricing that better balances supply and demand. Greater location efficiency, less congestion, reduced sprawl, and improved health are some of the agglomeration benefits that result from rationally priced transportation.

Direct Energy and Environmental Benefits of Pricing

The effort to reduce motor vehicle tailpipe emissions has been a U.S. priority since Congress first passed the Clean Air Act in 1970, enacting the nation's first car-pollution standards. Today's ultra-low-emission vehicles are 99 percent cleaner than their predecessors. Though technologically impressive, this is as much a testament to how highly polluting cars used to be. The focus has long been on gasoline and conventional pollutants; cleaning up diesel trucks progresses, albeit at a slower pace.



Today's cars are akin to computers on wheels. High-technology electronics have swept through the auto industry, replacing mechanical and hydraulic devices in vehicle engines and elsewhere in cars. To be sure, auto air pollution control is a dramatic success story.

Likewise, vehicle fuel consumption is also regulated. In 1975, following the Arab oil embargo, the United States adopted a fuel economy standard that cut the average new vehicle's fuel use in half within a decade. After stagnating for a generation, fuel economy standards have recently been tightened to further reduce oil use in the future.

Although remarkable energy and environmental gains have been made in the U.S. vehicle fleet, unfortunately, these benefits may not endure if the nation's transportation system investments continue on the same path. The emissions generated by the sheer size of the U.S. vehicle fleet and the trillions of miles it travels each year overtake gains made in cleaner and/or fewer emissions from vehicle technological improvements. Vehicles last longer with no guarantees that their emissions and fuel economy controls are equally as durable. New, unconventional fuels—ethanol, biofuels, tar sands, heavy oils, shale, and coal-to-liquids—have the potential to increase vehicle tailpipe (as well as fuel-cycle)⁹ emissions.

Pricing transportation is needed to protect the historic gains that have been made in air quality standards and further reduce motor vehicle energy consumption and emissions. Though charges on transportation do not replace standards, they do create an incentive for continued vehicle improvements so that standards are easier to attain. It is useful to briefly consider these important relationships.

FACT

19.4 lbs.

of carbon dioxide contained in an average gallon of gasoline; it's 22.2 pounds per gallon of diesel

Relationships Between U.S. Transportation and Energy

Unlike other economic sectors, transportation relies on petroleum to fuel 94 percent of its energy needs.¹⁰ In 2009, nearly 13 million barrels per day fueled U.S. mobility. Three times more oil was used to fuel the transportation sector than all U.S. industries combined, and the transportation sector consumed over an order of magnitude more oil than the commercial, residential, and utility sectors, as shown in figure 4.1. The relationship between oil and autos will be difficult to sever. Not only is the vehicle fleet slow to turn over,¹¹ the vast fuel infrastructure supplying transportation energy is locked into oil, at least in the near to middle terms. Moreover, the relationship will change—for better or worse—depending on what future energy sources are utilized to replace the shrinking global supply of conventional oil. There are about 70 vehicle and fuel system pairings, both renewable and exhaustible, and each has its own energy and environmental benefits and trade-offs.¹²

Relationships Among U.S. Transportation, Climate Change, and Air Pollution

U.S. transportation is responsible for a significant share—30 to 85 percent—of direct and indirect greenhouse gas emissions and climate-forcing

FIGURE 4.1

U.S. Petroleum Consumption by End-Use Sector, 2009

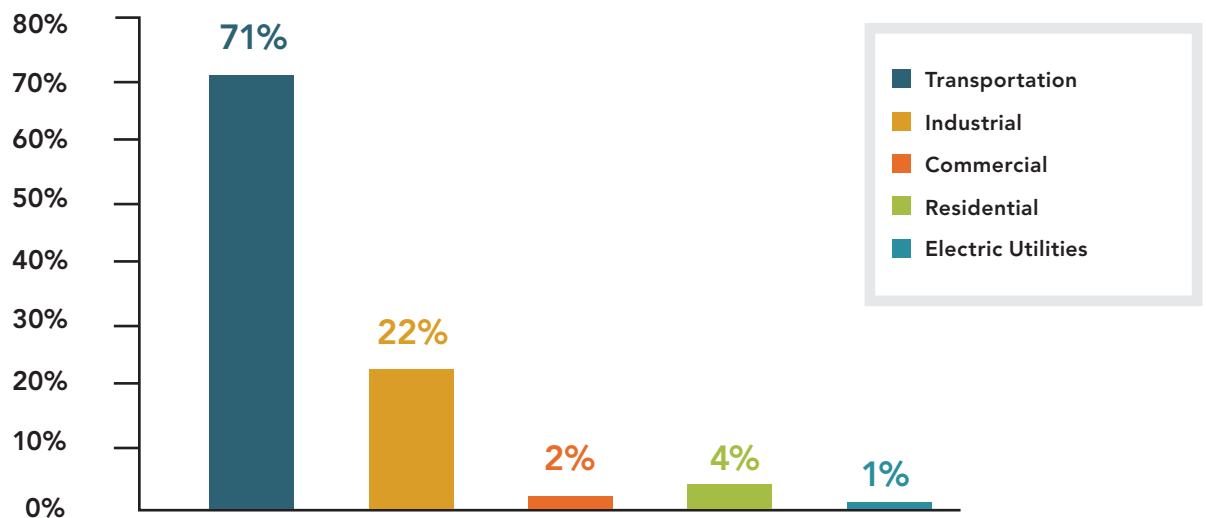
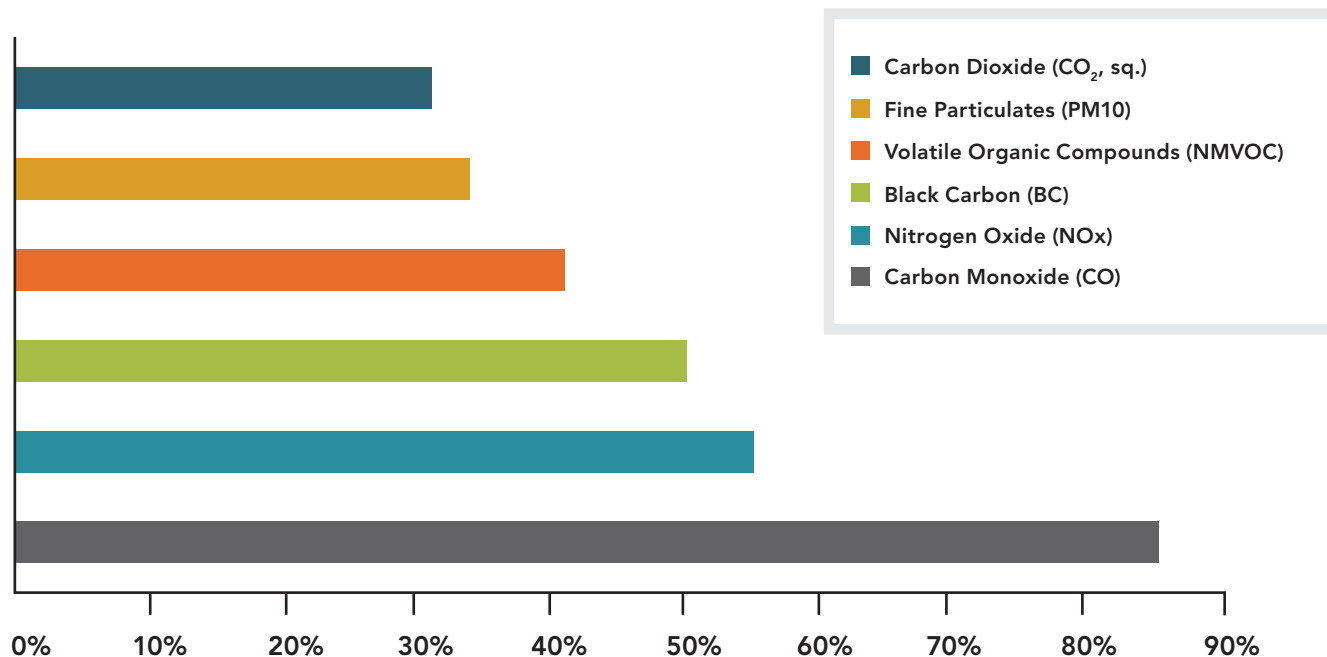


FIGURE 4.2

U.S. Share of Air Pollutants and Climate Gases Attributed to Transportation, 2009



air pollutants (see figure 4.2).¹³ Given the large volume of fossil fuels they consume, on-road modes of transportation—cars and trucks—are the major source of this pollution.

There is near parity between hydrocarbon (petroleum) energy use and the direct greenhouse gas, carbon dioxide (CO₂). Essentially all the carbon contained in fossil fuels is converted to CO₂ when burned.¹⁴ The amount of carbon released into the atmosphere is primarily determined by the carbon content of the fuel.¹⁵ The U.S. on-road transportation system runs almost exclusively on gasoline and diesel fuels. An average gallon of gasoline contains 19.4 pounds (8.8 kilograms) of CO₂. Diesel, the fuel primarily used in heavy-duty trucks and off-road vehicles, has 22.2 pounds (8.8 kilograms) of CO₂ per gallon.¹⁶ These emission rates will vary depending on the source and composition of the fuel feedstock.

Today, oil-fueled transportation is one of the key drivers of climate change. Research conducted by the Goddard Institute for Space Studies of the National Aeronautics and Space Administration and by other climate

FIGURE 4.1

SOURCE: Oak Ridge National Laboratory, *Transportation Energy Databook: Edition 29, table 1.13, 2010.*

FIGURE 4.2

SOURCE: Environmental Protection Agency, *"Inventory of US GHG Emissions and Sinks, 2010";* Environmental Protection Agency, *"Mobile National Inventory, 2008."*

agencies has found that on-road transportation has the greatest negative effect on climate, more than power generation or any other sector, especially in the short term.¹⁷ Cars and trucks emit almost no sulfates but are major emitters of CO₂, black carbon, and ozone—all of which cause global warming and are detrimental to human health. Throughout the twenty-first century, on-road transportation is expected to be a leading climate-forcing activity, in the United States and worldwide, as shown in figure 4.3.

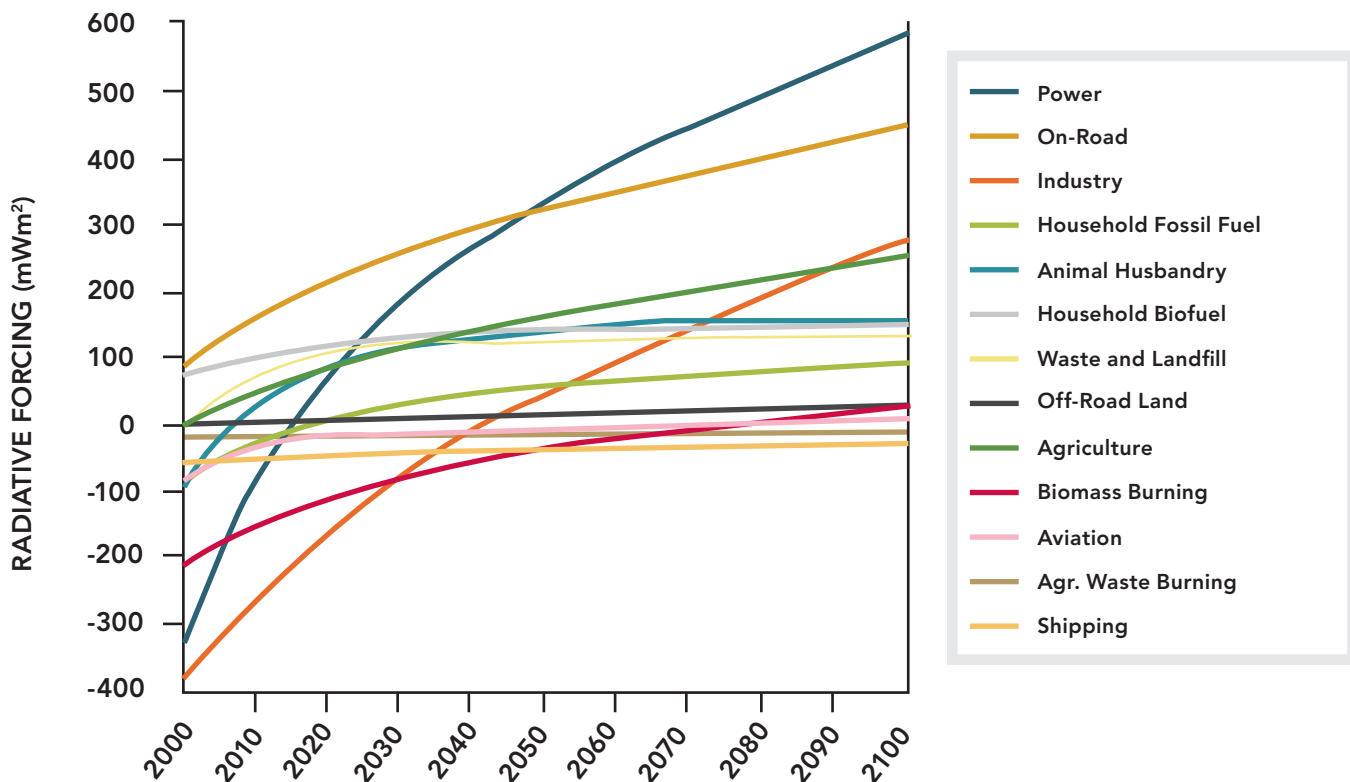
Traffic-related air pollution is estimated to cost as much as \$80 billion annually in health care costs and premature deaths.¹⁸ Pricing mechanisms can reduce private vehicle use and congestion, which would then reduce the health costs associated with air pollution. The transportation strategy adopted to reduce downtown traffic congestion for the 1996 Summer Olympic Games in Atlanta, for example, was found to have decreased peak ozone levels by 28 percent and asthma-related emergency room visits by children by 42 percent.¹⁹

Given the U.S. transportation system's contribution to carbon emissions and the connection to climate change, the exorbitant costs associated with climate change are worth considering but have yet to be fully quantified. Still, scientists warn that heavy precipitation, heat waves, drought and fires, melting ice caps, and tropical storms witnessed in 2010 are signs of troubling climate change already under way.²⁰ About two new high temperature records were set for every low temperature record during the 2000s.²¹ Though the effects of climate change will vary greatly across the United States due to the country's size, diverse topography, ecosystems, climates, and economies, as well as its dispersed populations and lifestyles, these changes are expected to impose huge costs, amounting to hundreds of billions annually, in terms of adaptation.²² Recent estimates predict that climate damage in 2100 could reach 2.6 percent of gross domestic product for the United States and 10.8 percent for the world.²³ Estimates of the costs of adapting to climate change can provide insight into the benefits of maintaining and protecting societal goods and services to avoid the most severe climate effects.

Mitigating the effects of climate change and air pollution would have widespread global and regional benefits. Reducing the rate of long-term carbon warming will benefit our grandchildren. Offsetting short-term climate forcing from reductions in air pollution—especially ozone, carbon monoxide, and black carbon—will directly benefit public health, reducing morbidity and mortality throughout the population. Transportation pricing will be necessary to make this shift in behavior.

FIGURE 4.3

A Century of Total Climate Forcing Due to Constant 2000 Emissions, by Global Sector



Indirect Economic and Other Co-Benefits of Pricing

Transportation policy reform, underpinned by transportation pricing, has the potential to bring about a host of societal benefits that contribute to the country’s security and general well-being. America’s transportation network is relatively mature, as are those of most wealthy nations, and improvements to such a system are more complex than simply adding capacity. Nearly all places are connected by at least one mode, and most major economic centers are connected by multiple modes.²⁴

Some of the inefficiency in the United States’ transportation system can be attributed to the fact that connectivity across the country relies heavily on roads and highways, leaving travelers few alternatives. Investment

FIGURE 4.3

SOURCE: Nadine Unger, Tami C. Bond, James S. Wang, Dorothy M. Koch, Surabi Menon, Drew T. Shindell, and Susanne Bauer, “Attribution of Climate Forcing to Economic Sectors,” *Proceedings of the National Academy of Sciences* 107 (2010): 3382–87. Reprinted with permission.

decisions are biased toward roads; cost-benefit analysis is ill equipped to identify the economic benefits of other strategies.²⁵ Alternatives such as walking, biking, and public mass transit vie for a smaller pool of resources and funding. At the same time, a largely free transportation system results in poor management and recurrent delays.²⁶ Finally, long-running subsidies and the failure to price transportation on the margin—charging for the next mile of driving—preclude the benefits of efficient transportation investments. This leads to a situation in which consumer trip choice is not guided by the true costs of available choices, but rather is determined by a set of policy decisions that do not necessarily result in greater social benefits.

For example, mobility options would give motorists alternatives when gasoline prices soar. Congestion pricing brings about more reliable travel in urban areas during peak hours, enhancing worker productivity.²⁷ Transit-oriented development contains sprawling metropolitan land-use patterns, centralizing infrastructure, and shortening distances between people and places.²⁸ Families could curb high household expenditures on transportation if they had mobility choices.²⁹ Consumers would reallocate their resources if hidden transportation costs were factored into housing purchase decisions through fuel taxes and location-efficient mortgages.³⁰ Developers would not gravitate to cheap suburban land, spreading out homes and businesses, if subsidies were removed for transportation and other infrastructure in those locations.

FACT

\$323 BILLION

total amount of foreign crude oil and petroleum products imported by the United States in 2010

In an effort to monetize the existing inefficiencies in the U.S. transportation system, this section presents the numerical findings of various studies. The following review of key literatures offers insight into potential benefits that could be reaped by pricing transportation effectively. A transportation system that is optimized through better pricing can help provide numerous benefits, which are also discussed below: more retention of dollars at home rather than shipping them abroad, greater mobility, improved public health, and increased agglomeration for economic productivity.

Retaining Dollars at Home

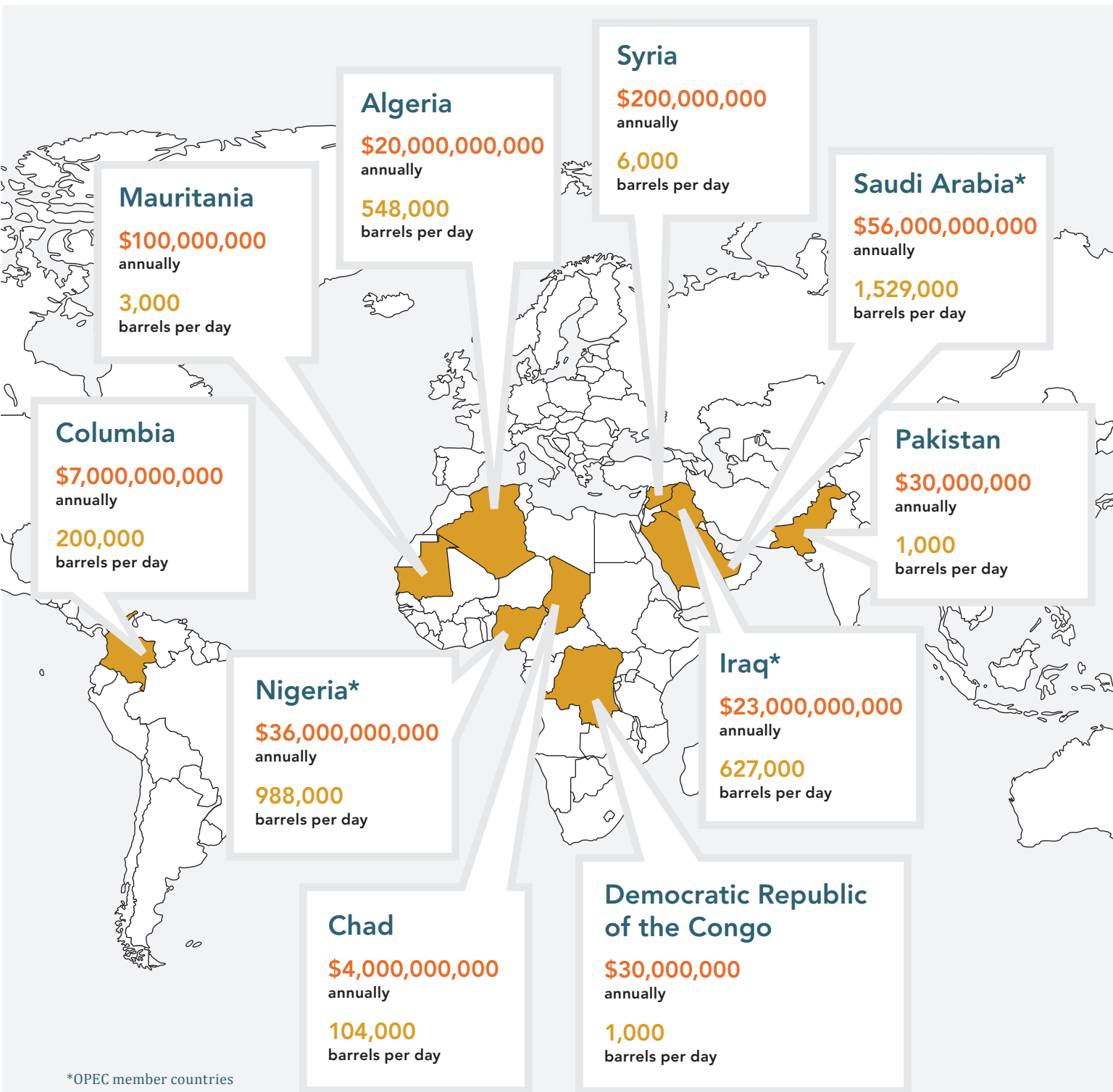
In 2010, the United States imported \$323 billion worth of foreign crude oil and petroleum products. This amount shipped abroad constituted 2.2 percent of gross domestic product and accounted for 17 percent of all spending on imports.³¹ In 2010, about 4.75 million barrels per day were purchased by the United States from nine countries that the State Department considered “dangerous or unstable” (figure 4.4).³² A portion of the

FIGURE 4.4

SOURCE: Rebecca Lefton and Daniel Weiss, “Oil Dependence Is a Dangerous Habit,” *Center for American Progress*, January 2010, www.americanprogress.org/issues/2010/01/pdf/unstable_oil.pdf.

FIGURE 4.4

Crude Oil Imports from Unstable Countries, 2008



\$140 billion from these sales likely went to foreign governments that were directly hostile to U.S. interests, including some that funded opposition forces in U.S. military engagements.³³ Reducing oil imports and keeping these dollars in domestic circulation would be an enormous benefit for both the economy and national security.³⁴

Gaining Greater Mobility

Traffic volumes in the United States have grown steadily during the past twenty-five years (and have only recently plateaued), wasting both time and money and imposing real costs on Americans. A transportation system that is better optimized through pricing and directed infrastructure investments could yield more efficient movement of goods and passengers, potentially reducing costs to firms that rely on the transportation network.

The Texas Transportation Institute has sought to document the cost of congestion through its annual Urban Mobility Report. The most recent report from 2010 found that the cost of wasted fuel and lost productivity amounted to \$115 billion in 2009.³⁵ Though the institute focuses on a stripped-down interpretation of trip time, other researchers are studying the impact that trip length has on congestion. These studies find that the average length of trips during peak commute times is also a significant factor in how travelers experience congestion. In cities that have the shortest peak travel distances, the typical traveler spends 40 fewer hours per year in peak-hour travel than the average motorist. In contrast, in areas with long trip distances, the average resident spends as much as 240 hours per year in peak-period travel.³⁶

For drivers, time spent behind the wheel caught in congestion is truly lost. And efforts to mitigate this lost time through multitasking by motorists cause distracted driving and increase the risk of traffic accidents. Providing alternatives to driving, however, frees travelers up for productive and social endeavors while in transit. Though travel time may not be significantly reduced, the quality of the time is transformed for the better.

Protecting Health and Welfare

Transportation pricing could reduce fuel use, stimulating public health benefits. It directly lowers harmful tailpipe emissions, decreases the rate of traffic accidents, and engenders more healthful mobility. Automobile dependence is closely linked to some of the leading causes of morbidity

and mortality in the United States. Transportation reform linked to smart growth policies that facilitate biking and walking can play a significant role in reducing the country's skyrocketing health care costs, which were estimated to be \$2.4 trillion in 2008 and could reach \$4.3 trillion by 2016.³⁷

More accurately priced transportation helps reduce the number of traffic accidents by limiting driving exposure and peak-hour use in congestion. Traffic crashes cause more than 40,000 deaths and cost \$180 billion each year.³⁸ Revenue generated from pricing can be directed to the implementation of more efficient street designs. Inefficient transportation designs, characterized by weak street connectivity, have higher automobile collision and pedestrian fatality rates.³⁹ Other studies show that the risks of accidents, injuries, and fatalities to pedestrians and bicyclists decrease when rates of walking and bicycling increase.⁴⁰

An automobile-dependent transportation system contributes to sedentary lifestyles and a lack of opportunity for daily physical activity. Low levels of physical activity are directly linked to the alarming obesity problem that costs Americans \$76 billion annually, approximately 10 percent of U.S. health care spending.⁴¹ There is a well-documented link between the built environment and physical activity, indicating that comprehensive land use and transportation planning that provides a sufficient level of street connectivity and destination density and supports alternatives to driving could save \$142 billion annually in obesity-related health care expenditures, lost wages, and premature deaths.⁴²

The literature provides extensive evidence that higher levels of physical activity are associated with urban design and infrastructure that support walking and cycling, mixed-use zoning, and greater access to public mass transit.⁴³ Walking associated with transit use is often enough to meet public health recommendations for physical activity of 30 minutes or more of moderate activity five days per week.⁴⁴ An analysis found that an average 3.4-mile bicycle commute in Madison, Wisconsin, expends 144 calories round trip, amounting to 10 pounds of weight lost during a year, which reduces risks of heart disease, stroke, breast cancer, colon cancer, and type II diabetes.⁴⁵

Providing Productive Connectivity

There is some evidence to support the concept that agglomeration benefits—that is, economic productivity increases due to dense clusters of

FACT

\$115 BILLION

total cost of wasted fuel and lost productivity due to traffic congestion in 2009



firms with convenient and affordable transportation and communication networks—can result from transportation pricing and strategic investments. Economic activity in clustered areas requires fewer and shorter automobile trips due to increased connectivity, density, and diversification of destinations. Studies show positive correlations between economic productivity and proximity/travel time, employment density, sector size, and city size. This is likely due to the fact that transportation costs are a key variable that determines the extent of economic opportunity—employees, customers, capital, and services—to which a business would have access. Transportation pricing with targeted investments can expand the number of business opportunities available to a firm by reducing travel times and the costs to access them.⁴⁶ The economic effects of this additional opportunity can be substantial, particularly in the service sector.

Though there is little agreement on the extent of agglomeration benefits, a variety of studies has shown them to be real and significant. One study found that agglomeration effects add value to the overall benefits of a transportation project, on the order of 10 to 20 percent.⁴⁷ An Australian

study found that, in Melbourne, employment density was the best predictor of economic productivity. Specifically, doubling the employment density of the city results in an average productivity increase of more than 7 percent.⁴⁸

Removing the Obstacles to Transportation Pricing

Any proposal to charge a price for something that is currently perceived as free—or cheap—will face substantial hurdles. Customers object strenuously to automated teller machine fees, airline baggage fees, and charges for Internet content, to cite just a few examples, in large part because all those things used to be free. In reality, nothing is truly free. Costs are bundled into advertising, airline tickets, and bank charges in the cases noted above and are thus transferred to consumers. So, too, with transportation—the public already pays with time stuck in congestion, in health and welfare by inhaling toxic air, in military expenditures for securing oil imports, and in other ways. But these costs are hidden from public view. Few travelers realize that these costs are assessed indirectly on them. In the private sector, consumers have little recourse against new fees other than refusing the service and shopping around. In the public sector, by contrast, citizens use their voices rather than their wallets to protest and often beat back any attempt to raise the costs. Government pricing of transportation—especially gasoline—attracts a lot of criticism. Service providers—such as oil companies, auto manufacturers, and real estate developers—fan the flames of consumer discontent because higher prices reduce demand, which in turn lowers sales—not the desired outcome.

The only realistic chance that the government has to impose new fees or taxes on something that is perceived as free is if the benefits are so clear that citizens will be willing to pay out of pocket for them. For example, London enacted congestion pricing relatively easily because the city government gained support over the fact that revenues generated would go toward mass transit improvements, thereby freeing up road capacity for drivers. By contrast, when New York City Mayor Michael Bloomberg proposed congestion pricing in 2007, it passed the City Council but failed to pass the state legislature. Part of the reason for this failure was the supporters' inability to demonstrate to the state that its constituents would also benefit from congestion pricing in New York City, for all the reasons set forth above. Despite the great need to experiment with different forms of transportation pricing—on roads, climate-affecting gases, emissions, and oil imports—policymakers will need to provide leadership to counteract public skepticism.

FACT

38%

of the poorest households nationwide do not own cars

Another barrier to pricing regards its potential equity effects. This is a serious concern. The distributional effects of pricing tend to fall hardest on the lowest-income individuals. This is especially true of goods that are necessities, for which there are no ready substitutes—and gasoline falls into this category. When prices rise, lower-income households must commit a larger share of their income for these items, which means they are disproportionately affected by increased prices. Such regressive effects are well known, but there are ways to deal with them. The most direct response is to compensate low-income individuals accordingly. This might mean giving poor people free mass transit passes, rebate checks, or other transportation benefits to reduce the harm taxes can bring to them. However, it is estimated that 38 percent of the poorest households do not own cars. The proportion of lowest-income individuals without a car is even higher in major urban areas—68 percent in New York, 50 percent in Philadelphia, 43 percent in Chicago, and 30 percent in Los Angeles.⁴⁹ This contributes to the argument that the lowest-income quintile might be better off if transportation were priced and a portion of the revenues were recycled back to them in the form of free, or inexpensive, transportation services and options.

However, even though pricing is very rational as an instrument to align supply with demand and capture externalities, it is challenging to quantify precise benefits. Thus there is a complex relationship between the external costs associated with the current U.S. transportation system and the benefit of reducing or avoiding these costs. Most costs do not fall proportionately on driving rates and fuel use. One exception is the direct climate-affecting gas CO₂, which is emitted for every mile driven. However, when fuel-cycle climate emissions are taken into account, a complex relationship takes hold. Likewise, harmful air pollutants with their respiratory effects do not vary directly with fuel use. Accidents may be correlated but do not vary directly with driving. Oil imports will not be slashed in direct proportion to gasoline consumption. And military expenditures will not likely be reduced dollar for dollar for every gallon of gasoline saved. Certain thresholds in the reduction of use must be met before meaningful benefit will be seen. This is further complicated by the fact that benefits will not necessarily accrue at the same rate that externalities are avoided. Yet, despite the lack of direct cause-and-effect relationships between pricing and benefits, the strong evidence in this chapter suggests that the United States cannot afford to continue to underprice transportation.

Conclusion

Americans do not pay their fair share for transportation. The discrepancy is even greater when considering freight movement by trucks. As a result, the government subsidizes mobility at great expense to welfare and productivity. To wit, pricing transportation and better optimizing transportation investments will bring tangible security benefits. Benefits accrue to individuals and society as a whole through reduced dependence on oil and cars. These benefits include reductions in fuel consumption; reductions in associated pollution; public health benefits, including improved respiratory health and greater levels of physical activity; more effective system utilization; more efficient movements of goods, services, and passengers; and economic benefits through agglomeration effects in commercial centers.

There is strong evidence to suggest that pricing transportation is both advisable and rational from an overall security perspective. Admittedly, benefits are generalized and widespread, while pricing transportation is imposed on all individuals. Taxation, especially of goods or services now perceived as free (but which, in reality, are quite expensive due to externalized costs), requires leadership and accountability. Also, it is important to note that pricing at the federal level differs from pricing at the local or state level given the federal structure of the U.S. government. Dollars captured at the federal level should be expended on projects of national significance or in support of state and local projects with widespread benefits. State and local revenues should be devoted to state and local projects. And the feasibility of all projects should be determined by rigorous cost-benefit analysis.

In the absence of strong leadership, pricing transportation is a difficult sell within the political process, even for the most compelling programs that directly advance widely accepted national goals such as national security, prosperity, and fiscal health. Moreover, without accountability systems and performance metrics to ensure that transportation revenues are directed toward projects that demonstrably enable economic growth while promoting public health and welfare, there is little or no reason for taxpayers and system users to maintain long-term support for transportation pricing. But with both of these aspects in place, pricing transportation is possible and can become a reality.





Transportation Solvency: An Insurance Policy for American Prosperity

America's continued security and prosperity depend, in no small part, on its ability to make strategic investments in transportation infrastructure. "Strategic" means connected to an acknowledged, compelling federal interest, and "investment" means the ability to advance the federal interest during the full life of a project. At a minimum, transportation must support the American economy, not the reverse. At the moment, this minimum standard is not being met. Transportation spending is digging an ever deeper hole in the federal

budget. It ignores the costs of deferred maintenance by not keeping up and rebuilding the existing system, it is focused more on managing local congestion than on long-term economic returns on investments, and it does not pay for the full costs it imposes on public health and welfare. In sum, this is a model for economic decline, not for a dynamic twenty-first-century economy.

Economic development models based primarily on resource exploitation are obsolete. During the past one hundred years, America has prospered under such a model. The nation's growth has been based on cheap energy, cheap land, relatively free travel, and subsidized suburban development. But this model is no longer viable. The transportation system that enabled this model has aged beyond its useful life and is in need of costly repair and replacement. The nation's dependence on oil imports has grown, and energy prices are a function of global markets beyond its control. The costs of maintaining and expanding the country's built infrastructure have soared, and subsidized land development has put increased financial pressure on governments to provide expansive public infrastructure they can no longer support. The nation needs a new development frame and a new financial model to support it.

For the nation's economic, energy, and environmental security, we recommend that a solvent transportation program be ensured through the stable pricing of oil and petroleum products.

Guideposts for Ensuring Transportation Solvency

The solutions for achieving transportation solvency are readily available. First, transportation investments must contribute to economic productivity, not merely offer short-term stimulus and temporary employment. Second, every dollar of investment must count; transportation programs that do not directly support U.S. security and prosperity goals must be eliminated. Third, energy security must be a central focus of transportation investment. Fourth, those who benefit both directly and indirectly from the transportation system should fund it. This will restore public trust.

Twenty-first-century transportation policy necessarily draws a close relationship between the program design *and* its funding mechanism. The consequences of an outdated program design, coupled with insufficient funding, go far beyond the fiscal health of the program itself. As described in the earlier chapters, as the relationship between transportation policy and its revenue strategy weakened, other negative outcomes resulted—insolvency, weaker contributions to economic productivity, greater vulnerability to energy price instability, and greater economic, social, and environmental costs borne by everyone. Tightening the relationship between the U.S. transportation program’s goals and its funding strategy can yield maximum return in the form of public investments that provide broad public benefits, including economic growth, price stability, energy security, and debt reduction through transportation solvency. These benefits, taken together, represent an insurance policy for American prosperity—specifically by ensuring economic growth, wise investments, energy stability, and solvent mobility.

Ensuring Economic Growth

No one remembers how many jobs were created in building the Interstate Highway System, yet we all still benefit from the economic boom that followed its construction. But America’s highway system has now reached the end of its design life of fifty years. It is time to rebuild—at an estimated cost of about \$2.5 trillion.¹ Although the states own the Interstate Highway System, as well as all other federally aided roads, the federal government has a critical interest in its continued health. We must also build the rail, mass transit, and connective infrastructure needed to compete in a twenty-first-century economy. Investments in transportation must ensure economic growth.

Ensuring Wise Investments

Political earmarks and a plethora of programs lead to irresponsible investments. The nation’s leaders thus must cut and consolidate—deeply—the 108 dispersed transportation programs, eliminating those that do not directly support national security and prosperity goals. Though it is difficult to analyze transportation investments against broad federal interests, that is not an excuse to abandon the effort. Cost-benefit analyses based on total return measured in public, not private, benefits, is critical. A permanent ban on earmarks is also necessary. Members of Congress can be excused for thinking that any investment in their districts is key to national prosperity. That is exactly why rigorous, objective analysis is required. A National Infrastructure Bank, with an independent board of directors charged with meeting national, not parochial, objectives, would be a step in the right direction. We recommend that Congress immediately enact these structural measures to guide transportation investments.

FACT

\$2.5 TRILLION

estimated cost to rebuild America’s highway system

Insuring Energy Stability

Given the numerous external risks to the transportation system, energy stability is a high priority for economic health and national security. America pays foreign countries about \$1 billion a day for imported oil—with more than 70 percent of that consumed by the transportation sector. Dependence on oil for more than 94 percent of the nation's transportation fuel embeds instability into the fuel supply, allowing disruptions to cause wild swings in oil prices and major damage to both the economy and household budgets. Wars, hurricanes, refinery fires, and growing global demand all play havoc with oil markets. Reducing reliance on oil as a transportation fuel must be a central focus of future transportation investment and pricing.

Because oil is the dominant transportation fuel, there can be no rapid transition away from it. However, there are ways to stabilize fuel prices in the short term, to allow consumers to better choose among purchase and lifestyle options, and to allow suppliers to plan long-term investment and production. Energy stability will build the confidence that the automobile industry needs to invest in high-efficiency and electric or alternative fuel-powered vehicles (such as electricity, natural gas, or advanced bio-fuels), and will give alternative energy companies a clearer idea of the market in which they compete. Pricing is the best way to promote market equilibrium in the face of planned and unplanned events.

Insuring Solvent Mobility

The federal government's compact with states and localities on transportation funding has traditionally been that the federal government will underwrite a major percentage of the capital costs of transportation investments that support national goals (now about 45 percent of such costs), and the states will pay the costs of maintaining and operating the system. However, the federal government has not lived up to its part of the bargain, both underfunding the capital costs of building and reconstructing significant transportation infrastructure nationally, and also failing to raise the revenues needed to do this work. It must reverse course. Strategic and stable revenue generation will help dig transportation out of its deficit hole and steer the United States onto the road to prosperity. The nation can raise the revenue needed to fund transportation in several ways. These include:

1. general revenues, generated at the federal level primarily by taxes on labor and capital;
2. consumption taxes, such as an excise tax or sales tax on transportation fuels or externality taxes on air and water pollution;
3. user fees, including charges for actual system use that are higher at peak travel times and lower in off-peak times; and
4. taxes on production, such as a manufacturing tax or royalty, on transportation fuels and vehicles.

Although all of these options have the ability to fund transportation, taxes on the production and consumption of transportation fuels form a demonstrably better strategy.

The Way Forward

We believe that the best strategy in the immediate term for the federal government is to price the production and consumption of transportation fuels. This strategy reflects the current transportation system and its dependence on oil by capturing and distributing the external, social, and hidden costs incurred in the production, refining, distribution, and consumption of such fuels. In the longer term, as U.S. dependence on oil as a transportation fuel declines, the nation can transition to travel-based fees, value capture of transportation investment benefits, and pricing of non-petroleum-based fuels. But the urgency of addressing the transportation deficit requires immediate action, and pricing transportation-related petroleum consumption is clearly the best choice.

The pricing structures for transportation fuels can be designed to avoid the need to tap general revenues that are already scarce. Pricing transportation fuel also establishes a mechanism to stabilize national consumer oil prices, which can be directly, and sometimes suddenly, jeopardized by violent swings in fuel prices. Moreover, pricing transportation fuels lessens the federal government's reliance on user fees that are collected and utilized by the owners and operators of the country's transportation system—which include state and local governments and, in certain circumstances, private transportation providers. The federal government is not an owner/operator of any significant highway, rail, or mass transit system, and thus it should not compete for the revenues generated from these systems.²

FACT

\$1 BILLION

amount the United States pays foreign countries per day for imported oil

Funding the federal transportation program does not remove the need for creative ways to finance transportation projects. A national infrastructure bank, public private partnerships, and the aforementioned user fees are key elements in transportation financing. However, many projects with high potential to advance critical national goals, as established through independent cost-benefit analysis, are not possible to finance through market mechanisms. For the federal transportation program to remain viable, it will require new funding that is separate from, and in addition to, these state and local project financing strategies.

The United States is not alone in its search for a funding solution for its transportation program. Most mature economies face similar challenges. Along with America, the developed economies that make up the other members of the Organization for Economic Cooperation and Development (OECD), with their mature infrastructures and an equal need to transition away from reliance on fossil fuels to power their transportation systems, are a good focus for comparative analysis.³ These countries have targeted energy and environmental taxes as a primary strategy for funding transportation infrastructure and guiding their economies away from reliance on fossil fuels.

A comparison of the revenues that OECD countries derive from energy and environmental taxes as a percentage of gross domestic product (GDP) is instructive (see figure 5.1).⁴ America ranks second lowest in the developed world in taxing pollution and fossil fuels. In the OECD nations, fuel taxes represent more than 70 percent of the retail price of transportation fuel; in the United States, fuel taxes represent just 12.8 percent of the fuel price.⁵ This tax level is too low to either pay for the system or to discourage the publicly damaging behavior, pollution, and waste caused by system overuse. Denmark, by comparison, made the conscious decision following the 1970s oil crisis to decouple economic growth from energy consumption. Today, Denmark is a net exporter of energy and uses less than half as much gasoline as the United States to generate one unit of GDP.⁶ From 1990 to 2008, Denmark's GDP increased by more than 45 percent while CO₂ emissions decreased by more than 13 percent.⁷

Establishing transportation solvency through a source of stable revenues will lead to a more secure, resilient, and prosperous nation. Fuel excise taxes have long served as the primary national transportation funding source. At least in the near term, oil is the fuel of choice for essentially the entire transportation sector. Pricing transportation fuel and its underlying oil sources remains the rational revenue source. Collection mechanisms are in place. Administrative costs are low. Current oil markets are

FIGURE 5.1

2009 Revenues From Environment-Related Taxes (percentage of gross domestic product)

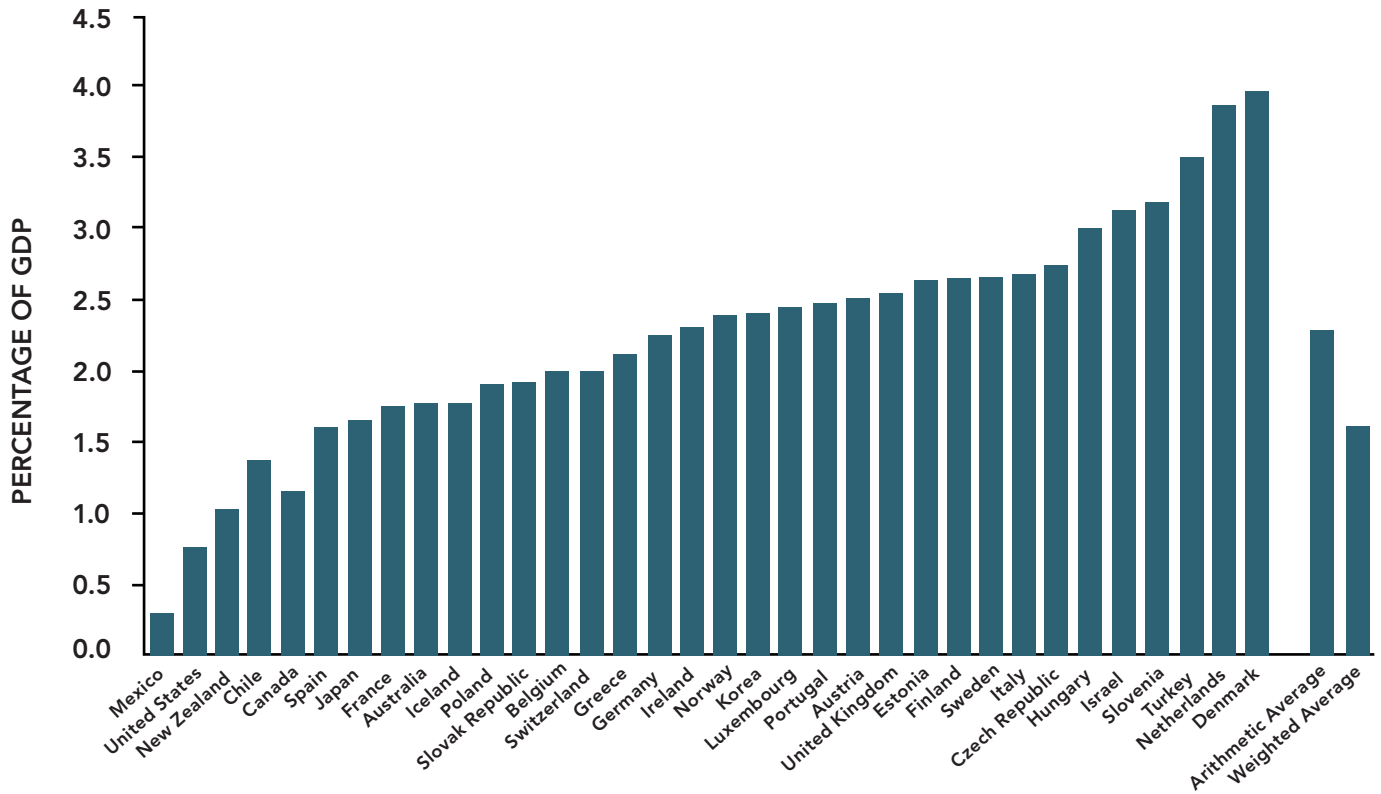


FIGURE 5.1

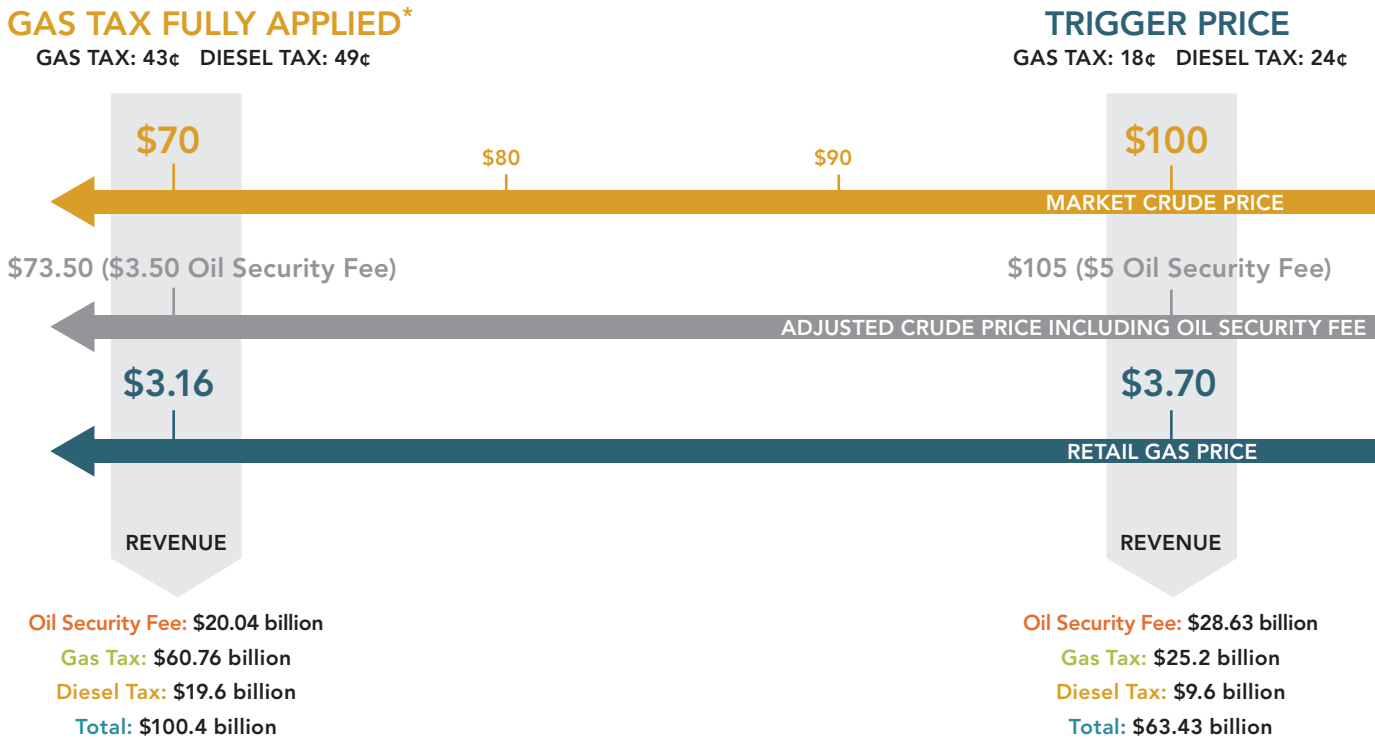
SOURCE: OECD and European Environment Database, "Database on Instruments Used for Environmental Policy and Natural Resources Management," updated March 1, 2011, www2.oecd.org/econst/queries/index.htm.

dysfunctional and inefficient. There is a strong public association between fuel use and transportation services. And fuel pricing can transition over time from oil to other transportation fuels as the United States weans itself from oil.

We are fully aware of the public resistance to fuel taxes. Nevertheless, the public also believes the federal government underfunds transportation and does a poor job of project selection. Two of three voters say that improving the nation's infrastructure is highly important, and that the United States' current infrastructure is inadequate.⁸ Few believe that current federal transportation spending practices are efficient and wise, and voters welcome a range of reforms in how transportation projects are financed. The public views reform in this area as a way to improve the economy, make communities safer, and improve Americans' quality of life.⁹ Given the gravity of the transportation funding problem, the high level of public support for federal deficit reduction, and the great need for both

FIGURE 5.2

Variable Gas Tax (0¢–43¢) + 5% per Barrel Oil Security Fee on Domestic and Foreign Oil Imports



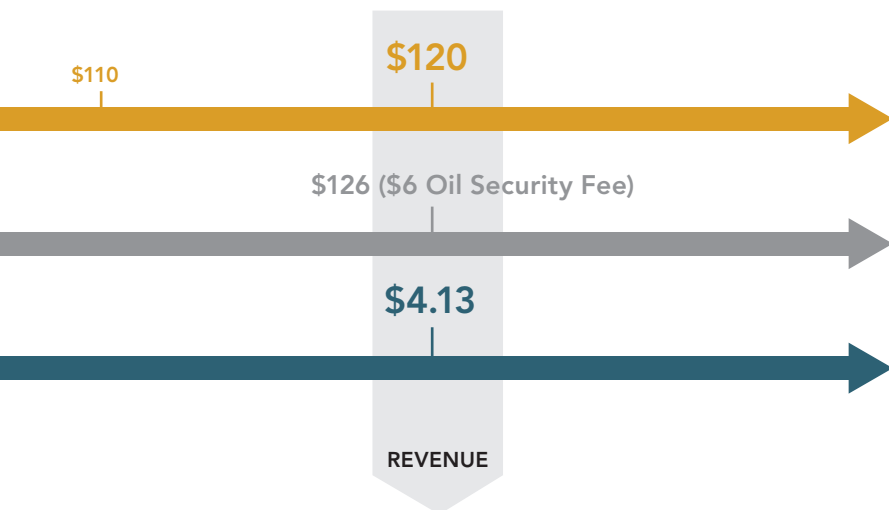
structural reform and improvements in project selection, it is our firm belief that the public will support new petroleum-based taxes and fees. However, the public must have confidence that such taxes and fees will be fairly applied across all potential taxpayers (producers as well as consumers) and that the revenues will be invested to maintain American leadership in the globally competitive economy of the twenty-first century.

The Transportation Solvency Plan

We recommend that Congress adopt an oil security and price-stabilization fee that will grow the economy and reduce oil dependence, while providing Americans with an insurance policy against future oil shocks. The stable revenues generated from this oil security and price stabilization fee will provide the funding needed to provide healthy infrastructure that

GAS TAX ABATED**

GAS TAX: 12¢ DIESEL TAX: 18¢



Oil Security Fee: \$34.35 billion
 Gas Tax: \$16.43 billion
 Diesel Tax: \$6.93 billion
 Total: \$57.71 billion

ASSUMPTIONS: EIA 2011 Estimate: gasoline—\$3.70, crude—\$102; Extrapolating expected revenue of the Oil Spill Liability Trust Fund suggests 5.725 billion barrels/year of domestic production + imports; \$1.4 billion in annual revenue for each 1¢ of gas tax (AASHTO); \$0.4 billion in annual revenue for each 1¢ of diesel tax (AASHTO); each \$1 increase in crude oil results in an increase of 2.5¢ in the retail price of gasoline. Although this provides an estimate of \$4.11/gallon gasoline when crude is \$120, this is likely too high. In July 2008, with crude prices around \$145, gasoline averaged \$4.00/gallon; Currently, 16% of gas tax revenues and 12% of diesel revenues accrue to the Mass Transit Account, not the HTF. This model assumes that all gas and diesel revenues will accrue to a single "Transportation Trust Fund"; Retail price estimates include adjustments for the addition or subtraction of gas tax; revenues do not include nonfuel revenue streams into the HTF (approx. \$5 billion per year). This illustration caps the gas/diesel tax addition at 25¢. For illustrative simplicity, it is assumed that 100% of per barrel fee is absorbed upstream and 100% of gas tax adjustments are absorbed downstream by the consumer. Thus, retail gas price reflects no change from oil security fee.

* 1¢ of fuel tax added for each \$1 drop in crude price below trigger. ** 1¢ of fuel tax removed for each \$3 increase in crude price above trigger.

enables economic growth; put transportation funding back on a secure, pay-as-you-go basis; support innovation in the domestic energy and automobile industries; and arrest the rapidly growing contribution of transportation to the national debt.

Specifically, our proposal assesses a 5 percent ad valorem tax on oil upstream (at production or importation) as the world oil price rises, while taxing gasoline/diesel downstream (retail sales) as the world oil price declines. This will dampen oil demand on the way up (to avoid a price spike) and slow price crashes on the way down (to encourage price stabilization and recover reductions in ad valorem tax revenues due to lower oil prices). If prices get too high or too low despite these efforts, the ad valorem tax can be recalibrated, as necessary, to stabilize transportation fuel costs while also providing a stable, predictable revenue stream designed to advance federal goals, as outlined in the earlier chapters of this report.

Fuel price stabilization and transportation solvency can be effectively pursued by setting a price point based on the world price for oil that guides both upstream and downstream oil pricing. Above this price point, oil is gradually taxed more upstream through the ad valorem oil security tax. Conversely, below the price point, gasoline taxes are raised to recover lost revenues from lower upstream oil prices. Using these two policy mechanisms, it is possible to generate with almost mathematical certainty whatever level of transportation funding is needed to restore the solvency of the transportation trust fund and invest in future transportation on a pay-as-you-go basis.

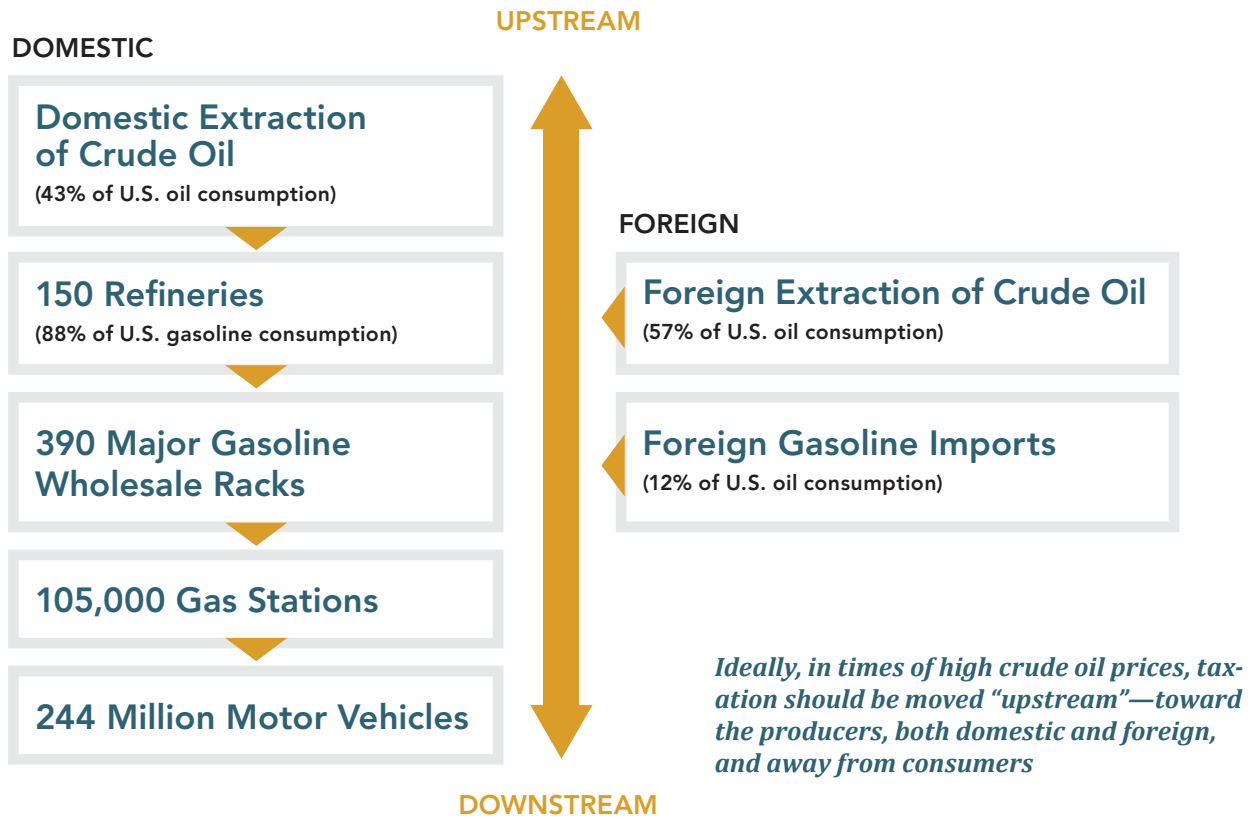
Figure 5.2 illustrates how this funding plan could work. In this example, the price point is set at \$100 a barrel, approximately the world price of oil today.¹⁰ At this point, the 5 percent ad valorem tax yields \$5 for every barrel of oil taxed and would supplement the present federal gas tax of 18 cents per gallon for gasoline, and 24 cents per gallon for diesel fuel. As the world price of oil rises, the federal gas tax is gradually abated as revenues from the oil security tax rise. As the world oil price declines, the federal gas tax is gradually restored as oil security revenues decline.

Likewise, as oil prices fall below \$100 a barrel, oil security taxes continue to decline and gasoline taxes rise above present federal gas tax levels to maintain revenues. However, the rise in gasoline taxes is set to lag the price of oil so that consumers will continue to experience a net reduction in the retail price at the pump. The result is a constant revenue stream into the transportation trust fund that can be calculated with sufficient accuracy to keep the fund solvent at whatever level of investment is desired.

This is not a funding panacea. It cannot control overarching world oil market conditions. The world price of oil could rise enough so that the federal gas tax is entirely abated (in the example above, that would be \$154 a barrel). At that point, the transportation trust fund would rely entirely on oil security tax revenues, gradually increasing revenues as oil prices continued to climb. Though this would still yield more revenues than the present gas tax now generates, it may not meet the country's transportation investment needs. Similarly, if oil prices drastically decline, revenues from oil security taxes may decline to the point that the gas tax, to which it is inversely calibrated, rises above acceptable levels. For this reason, Congress should set limits on both the upside and downside beyond which the correlation between oil security taxes and gas taxes does not vary. In our example, we set the limit at \$30 per barrel on either side of the price point. Ideally, Congress

FIGURE 5.3

Distributed Oil Pricing for Transportation Solvency



would set the variable price limit to generate, at a minimum, the amount needed to fully fund its legislated transportation program.¹¹

FIGURE 5.3

SOURCE: EIA, EPA Inventory, 2004 CRS report.

Benefits of the Proposal

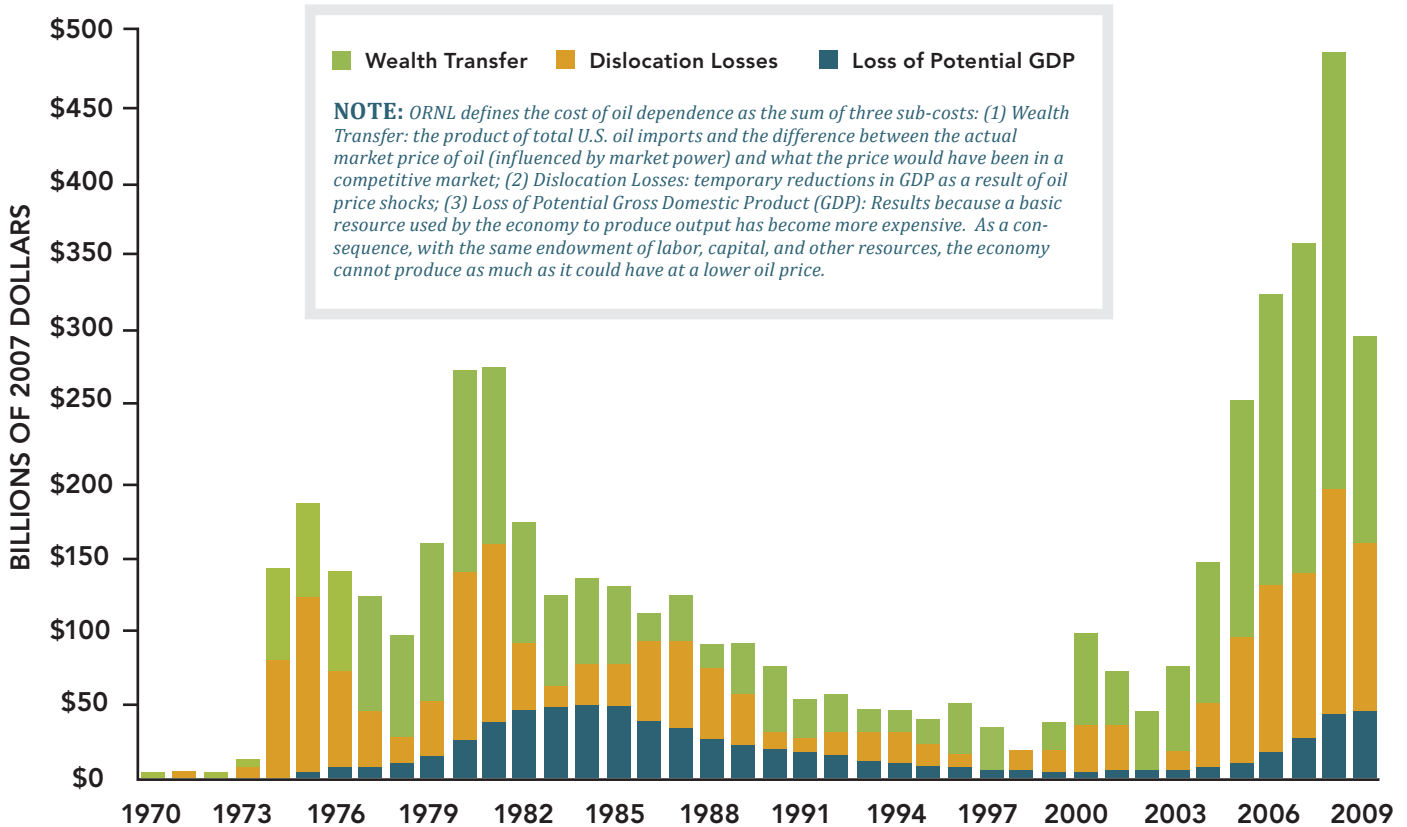
The main purpose of the funding proposal outlined above is to restore solvency to the national transportation program while serving other needs. This proposal will promote U.S. energy security and reduce the economic impact of fluctuating world oil prices on the nation. Four other benefits will also accrue.

First, the proposal would distribute revenue responsibilities along the oil value chain from energy production to consumption. Pricing fuels at the retail level—gas and diesel taxes in the case of surface transportation to-day—provides a necessary signal to consumers to use fuel and the transportation system more efficiently. At present, however, fuel taxes alone do not generate enough revenues to even maintain the transportation system, much less rebuild it to support the twenty-first-century infrastructure underpinning the U.S. economy. Distributing prices up and down the oil value chain increases the likelihood that oil producers, refiners, wholesalers, and distributors will share in absorbing the effects of an oil security tax (figure 5.3). This vertical pricing approach is equitable, because oil producers

FIGURE 5.4

SOURCE: David L. Greene and Janet L. Hopson, "The Costs of Oil Dependence 2009," Oak Ridge National Laboratory Memorandum, 2010. Reprinted with permission.

FIGURE 5.4 Lost Productivity Due to Oil Imports





underwrite a portion of the costs for building and managing the transportation systems from which their profits are derived.

Second, the proposal would insure transportation solvency against external events over which America has no control. Oil prices rise and fall for a variety of reasons—wars, supply disruptions, fear, hoarding, speculation in oil markets, and direct manipulation of markets by foreign oil suppliers. Oil markets can also be disrupted by nonmarket, inadvertent occurrences—weather patterns, accidents, and seismic activity. The most effective way to insure against oil price instability is to build the cost of oil dependence into the commodity price itself. As noted in figure 5.4, the macroeconomic cost (productivity loss) of the nation’s dependence on foreign oil averaged about \$300 billion per year during the period 2004–2009. This amounted to \$50 per barrel consumed in the United States each year.¹² If oil use were priced more efficiently, the United States could capture significant opportunity costs and use the revenues for productive purposes. This is a corollary benefit of assessing a modest 5 percent security tax on the price of oil.

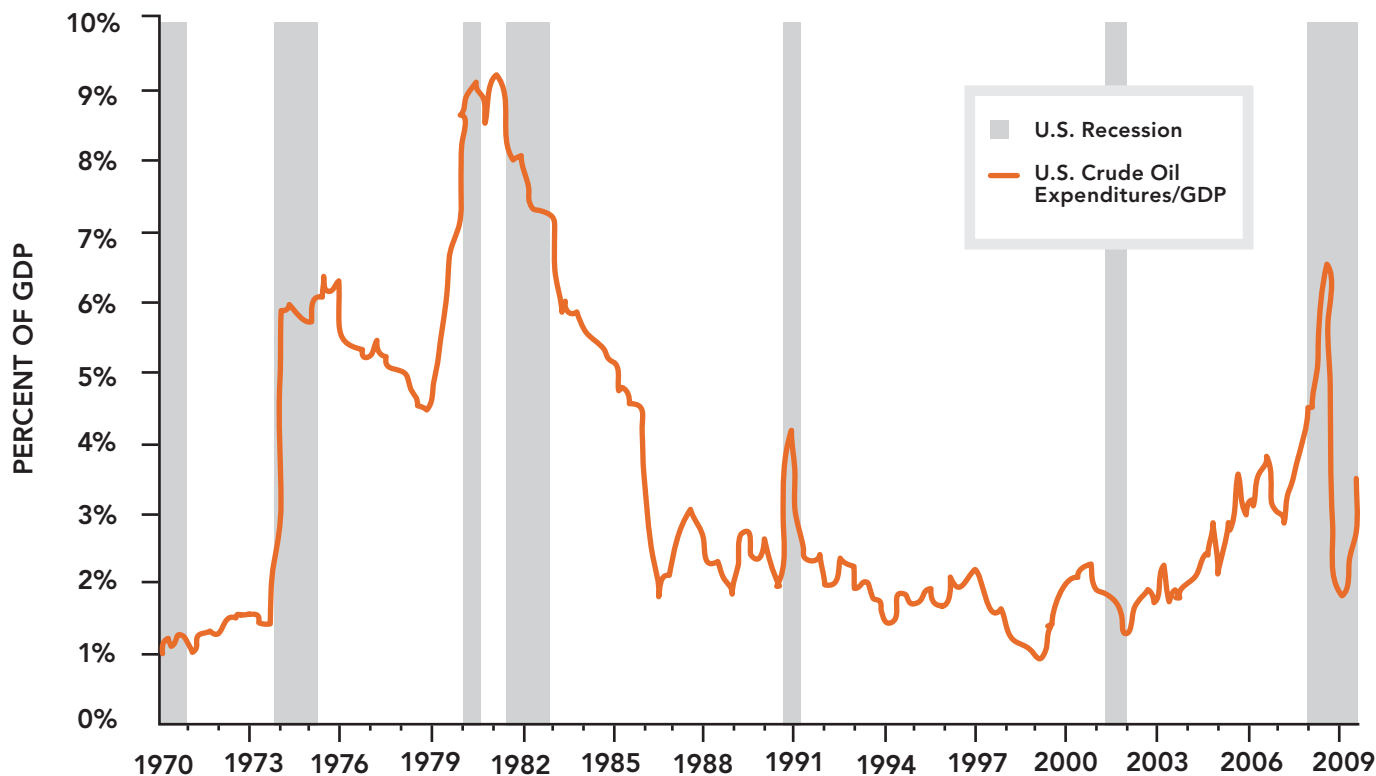
Third, the proposal would stabilize fuel prices for both producers and consumers for long-term market equilibrium. Policies with the potential to dampen both precipitous spikes and collapses in the oil price would make the U.S. economy more resilient. By increasing oil taxes as oil prices rise,



and increasing gas taxes as oil prices drop, this plan tends to guide retail fuel prices (including taxes) to stay within a certain range—ideally around the price point to which fuel taxes and oil security taxes are inversely related. At the price point of \$100 per barrel, this would guide gasoline prices to the range of \$3.40 to \$3.70 a gallon. This is considered a high price in the United States, but it is still nowhere near as high as the average retail price of more than \$6.00 a gallon set by America’s OECD trading partners. It also provides a price signal that can affect consumer car purchasing behavior. This strategy avoids the “panic/trance” of violent oil price swings that can crash both the U.S. economy and household budgets.¹³ It also moderates shifts in oil prices that may contribute, in part, to economic recessions (see figure 5.5).

And fourth, the proposal would support strategic transportation investments with long-term viability and productivity. When the Interstate Highway System was launched in 1956, the United States was a net exporter of oil. The construction of the highway system stimulated road travel to such an extent that the United States became a net oil importer in 1970 and has since become increasingly dependent on oil imports for transportation. The shift from domestic oil supplies to imports has made the United States far less recession-proof since 1970, as illustrated in figure 5.5. Oil price spikes have the potential to do far more damage today than they did in the 1950s, when the Interstate Highway System was under development. Future transportation investments need to take this into account. Using oil tax revenues to invest in more travel choices reduces the total oil consumption per unit of GDP. This enhances American security and productivity.

Reforming America’s transportation system to grow the economy, reduce the deficit, and restore the transportation trust fund to solvency will not happen quickly. Nevertheless, it is critical to realize that the United States cannot build its way out of its transportation problems.

FIGURE 5.5**U.S. Crude Oil Consumption as a Percentage of Gross Domestic Product**

It is time for a significant recalibration. America needs greater, targeted investment in projects that grow the economy and serve the key national objectives of security and prosperity. System costs—both direct and hidden—must be incorporated into the transportation pricing system. The United States can no longer afford to run huge annual deficits in program funding. It is incumbent upon policymakers to lay the groundwork for generations to come.

We can—we must—do better. The recommendations outlined here can restore public trust by restoring the solvency of the nation's transportation program. They thus constitute a sound plan for investing in America.

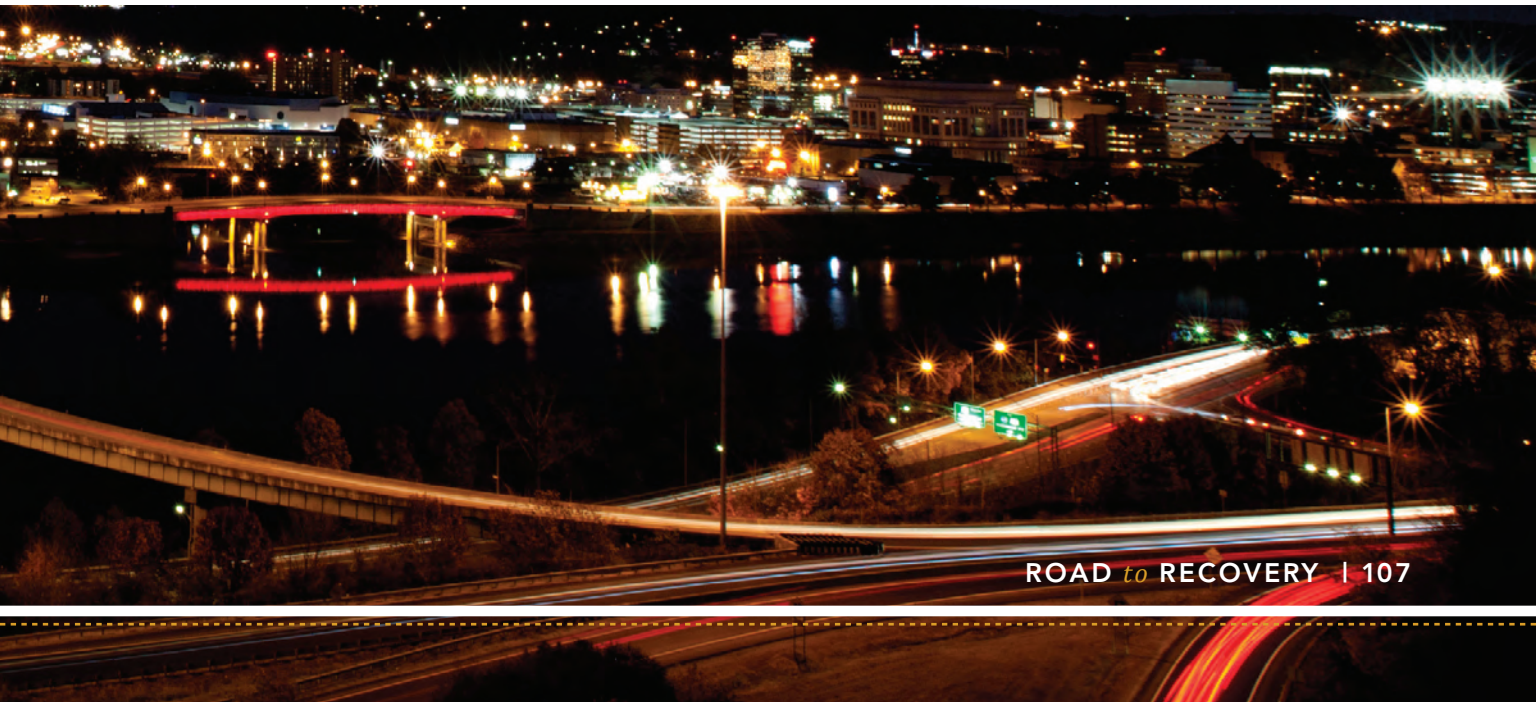
FIGURE 5.5

SOURCE: Data from U.S. Energy Information Administration.

Our federal transportation program is insolvent and it is no mystery why.



Its goals are unclear, the strategy for achieving those goals is inadequately explained, benchmarks for performance are few and far between, and there is little accountability for results, with more than 80 percent of funds distributed by formula rather than by need or performance. More significantly, the transportation program has lost the confidence of the general public; few believe that transportation taxes are cost-effective and spent well to advance specific national goals.



This state of affairs, however, is no excuse to abandon the federal transportation program. Just the opposite is true. Integrated, efficient, and cost-effective transportation networks that provide timely access to goods and services are the foundation of a twenty-first century economy. Such networks should exhibit the characteristics of all sustainable systems—robust, redundant, reliable, and resilient. In contrast, our transportation networks are fragmented, lacking in operational control, unreliable, deteriorating through deferred maintenance, and brittle—they tend to collapse in times of natural or manmade crisis. They are also inefficient, representing over 70 percent of total domestic oil consumption, most of which is imported. This augments the risk already present in any potential disruptions in oil supply lines. Defending these supply lines is, in part, an added cost of transportation.

If America is to remain a global economic power while advancing our common aspirations for a better quality of life, we need to re-invest in America, especially in our transportation infrastructure. Building a nationwide rail system in the nineteenth century created the connections that enabled the United States to survive and grow as one nation. Likewise, building an interstate highway system in the twentieth century created an integrated economy and enhanced personal mobility. Our newfound “freedom to travel” was an early form of social networking that helped spark fundamental economic and social change. In these ways and many more, robust and healthy transportation networks are fundamental to national—and thus social—progress.

It is time to rebuild and strengthen our national transportation program. This requires two things: reform and revenue. The diagnostics of the problem—too many programs, too few clear goals, too little strategic leadership, and almost no accountability for results—are clear. These problems call out for reform. There is also the key problem of deferred maintenance—this is no more than a hidden tax, with interest, on our children and grandchildren. If “living within our means” includes good husbandry of our existing system, we need more, not less, investment in transportation. That means more revenues that are wisely spent to meet our obligations for ourselves and for future generations.



Finally, we squarely confront the issue of how to fund a twenty-first century transportation system. The nation is too dependent on foreign oil and transportation is the culprit. Therefore, oil taxes should provide the insurance policy we need to defend ourselves from periodic oil shocks, while providing the revenues we need to build a more energy-efficient transportation network. Our proposal—a counter-cyclical tax on both oil (when oil prices rise) and transportation fuels (when oil prices decline)—is fair and effective, two qualities of smart revenue policy.

Our plan is an insurance policy for American security and prosperity. It is proactive, bipartisan, and focused on results. Its success depends on leadership that reflects these same qualities. **Now is the time to act.**

SUMMARY

- 1 CEIP analysis based on the following data: Michel Audige, et al., “Road User Charges: Current Practice and Perspectives in Central and Eastern Europe,” World Bank Group, Transport Papers: TP-23, November 2008; Government of Australia, “Public road-related expenditure and revenue in Australia 2009,” Department of Infrastructure, Transport, Regional Development, and Local Government, Bureau of Infrastructure, Transport and Regional Economics, November 2009, www.bitre.gov.au/publications/38/Files/IS37_RoadExpend.pdf; Government of Canada, “Transportation in Canada 2009: An Overview,” Minister of Transport, Infrastructure, and Communities, June 4, 2010, www.tc.gc.ca/media/documents/policy/overview2009.pdf; Cesar Queiroz, “An Overview of Road User Charging Systems,” Polish Ministry of Transportation and World Bank Workshop on Road User Charging Systems, Powerpoint Presentation, June 11–12, 2007; and U.S. Government, “Status of the Federal Highway Trust Fund,” Highway Statistics 2008, Federal Highway Administration, U.S. Department of Transportation, October 2009, www.fhwa.dot.gov/policyinformation/statistics/2008/fe10_2009.cfm.
- 2 Sacramento Area Council of Governments (SACOG), “Metropolitan Transportation Plan 2035 Issue Brief,” October 2006, www.sacog.org/mtp/pdf/MTP2035/Issue%20Briefs/Road%20Maintenance.pdf.
- 3 Theofanis Mamuneas and Ishaq Nadiri, “Production, Consumption and Rates of Return to Highway Infrastructure Capital,” preliminary draft, August 2006. https://editorial.express.com/cgi-bin/conference/download.cgi?db_name=IIPF62&paper_id=11.
- 4 Ibid.
- 5 U.S. Bureau of the Census, Foreign Trade Division, January 2011, www.census.gov/foreign-trade/Press-Release/current_press_release/exh17.txt.
- 6 U.S. Bureau of the Census, Statistical Abstract of the U.S., 2011, Table 1299, www.census.gov/compendia/statab/2011/tables/11s1299.pdf.
- 7 U.S. Energy Information Administration, “US Imports by Country of Origin,” February 25, 2011, www.eia.doe.gov/dnav/pet/pet_move_impcus_a2_nus_ep00_im0_mbbldpd_m.htm; and U.S. Department of State, Travel Warnings, March 11, 2011, http://travel.state.gov/travel/cis_pa_tw/tw/tw_1764.html.
- 8 Deborah Gordon, “The Role of Transportation in Driving Climate Disruption,” Carnegie Paper, Carnegie Endowment for International Peace, December 2010.
- 9 Nadine Unger et al., “Attribution of climate forcing to economic sectors,” Proceedings of the National Academy of Sciences (PNAS), June 2009, www.pnas.org/content/early/2010/02/02/0906548107.full.pdf+html and Adam Voiland, “Road transportation emerges as key driver of warming: NASA analysis,” Post Carbon Institute Energy Bulletin, February 18, 2010, <http://www.energybulletin.net/node/51744>.
- 10 Brookings Institution, *Bridge to Somewhere*, June 2008; National Surface Transportation Policy and Revenue Study Commission, *Transportation for Tomorrow*, January 2008; National Surface Transportation Infrastructure Financing Commission, *Paying Our Way: A New Framework for Transportation Finance*, February 2009; Bipartisan Policy Center, *Performance Driven: New Vision for U.S. Transportation Policy*, June 2009; Miller Center of Public Affairs, *Well Within Reach: America's New Transportation Agenda*, October 2010, http://web1.millercenter.org/conferences/report/conf_2009_transportation.pdf.

CHAPTER 1

- 1 Douglas Elmendorf, "Spending and Funding for Highways," Congressional Budget Office, January 2011, www.cbo.gov/ftpdocs/120xx/doc12043/01-19-HighwaySpending_Brief.pdf; Douglas Elmendorf, "The Economic Outlook and Options for Fiscal Policy," Congressional Budget Office, October 27, 2010, www.cbo.gov/ftpdocs/119xx/doc11948/10-27-2010-ForecastersClub.pdf.
- 2 This figure was given by the Congressional Budget Office in January 2011.
- 3 Ibid.
- 4 U.S. Government Accountability Office, "Overview of Highway Trust Fund Estimates," GAO-06-572T, April 2006.
- 5 Congressional Research Service, "Surface Transportation Reauthorization Legislation in the 111th Congress," August 2009.
- 6 Congressional Budget Office, "The Budget and Economic Outlook: Fiscal Years 2011 to 2021," January 2011.
- 7 Congressional Research Service, "Surface Transportation Reauthorization Legislation."
- 8 Federal Highway Administration, "Status of the Highway Trust Fund—Fiscal Year 2011," HPLS-10, table FE-1, www.fhwa.dot.gov/highwaytrustfund/index.htm#b. And in its most recent estimates, the Congressional Budget Office projected that the HTF will reach insolvency in the spring of 2013. But these projections are subject to changes in driving patterns, the global economy, and the rate of state construction projects, among many other factors.
- 9 The HTF is credited with receipts from the sale of gasoline, diesel, and other motor fuels. The HTF is also credited with revenues from an excise tax on tires used by heavy trucks, a sales tax on heavy trucks and trailers, and an annual tax on the ownership of heavy trucks.
- 10 Federal Highway Administration, "Status of the Highway Trust Fund."
- 11 National Priorities Project, http://nationalpriorities.org/media/uploads/publications/npp-tax_day_2010.pdf.
- 12 Miller Center of Public Affairs, "Well Within Reach: America's New Transportation Agenda," October 2010, http://web1.millercenter.org/conferences/report/conf_2009_transportation.pdf.
- 13 Barry B. LePatner, *Too Big to Fail: America's Failing Infrastructure and the Way Forward* (New York: Foster Publishing, 2010); Larry Galehouse, *Innovative Concepts for Preventative Maintenance, Transportation Research Record 1627* (Washington, D.C.: U.S. Transportation Research Board, 1998).
- 14 Ibid.
- 15 This is for highways only; the number is given by Chad Shirley and Clifford Winston, "Firm Inventory Behavior and the Returns from Highway Infrastructure Investments," *Journal of Urban Economics*, vol. 55 (2004): 398–415, citing Bureau of Economic Analysis, "Survey of Current Business," September 2000.

- 16 U.S. Treasury, "Interest Expense on the Debt Outstanding," October 2010, www.treasurydirect.gov/govt/reports/ir/ir_expense.htm.
- 17 Sacramento Area Council of Governments, "Metropolitan Transportation Plan 2035 Issue Brief," October 2006, [www.sacog.org/mtp/pdf/MTP2035/Issue percent20Briefs/Road percent20Maintenance.pdf](http://www.sacog.org/mtp/pdf/MTP2035/Issue%20Briefs/Road%20Maintenance.pdf).
- 18 A broad sampling suggests that most industrial countries fund their transportation systems with general revenue. In these countries, transportation user fees contribute to those general revenues, and usually contribute more than the transportation program receives back. As the funding structure of each transportation program is unique, however, an examination of only federal-level transportation revenues and expenditures may not provide the complete picture. See Michel Audige et al., "Road User Charges: Current Practice and Perspectives in Central and Eastern Europe," Transport Paper TP-23, World Bank, November 2008; Bureau of Infrastructure, Transport, and Regional Economics of the Australian Department of Infrastructure, Transport, Regional Development, and Local Government, "Public Road-Related Expenditure and Revenue in Australia 2009," November 2009, www.bitre.gov.au/publications/38/Files/IS37_RoadExpend.pdf; Canadian Ministry of Transport, Infrastructure, and Communities, "Transportation in Canada 2009: An Overview," June 2010, www.tc.gc.ca/media/documents/policy/overview2009.pdf; Cesar Queiroz, "An Overview of Road User Charging Systems," PowerPoint presentation at workshop on road user charging systems sponsored by the Polish Ministry of Transportation and World Bank, June 11–12, 2007; and Federal Highway Administration, U.S. Department of Transportation, "Status of the Federal Highway Trust Fund," October 2009, www.fhwa.dot.gov/policyinformation/statistics/2008/fe10_2009.cfm.
- 19 U.S. Department of the Treasury and Council of Economic Advisers, "An Economic Analysis of Infrastructure Investment," October 11, 2010.
- 20 "The Cracks are Showing," *Economist*, June 26, 2008, www.economist.com/node/11636517?story_id=11636517; "Building BRICs of Growth," *Economist*, June 5, 2008, www.economist.com/node/11488749.
- 21 U.S. Department of the Treasury and the Council of Economic Advisers, "An Economic Analysis of Infrastructure Investment."
- 22 The actual construction of the lighthouse was blocked for several years because of vandalism by local wreckers who depended on a steady supply of wrecked boats to pillage.
- 23 Stanley Engerman and Kenneth Sokoloff, "Governance in the Building of the Erie Canal and Other Public Works," in *Corruption and Reform: Lessons from America's Economic History*, edited by Edward Glaeser and Claudia Goldin (Chicago: University of Chicago Press, 2006), 106.
- 24 National Cooperative Highway Research Program, "The Economic Impact of the Interstate Highway System," June 2006, www.interstate50th.org/docs/techmemo2.pdf.
- 25 "The Cracks are Showing"; "Building BRICs of Growth."
- 26 Theofanis Mamuneas and Ishaq Nadiri, "Contribution of Highway Capital to Industry and National Productivity Growth," report prepared for Apogee Research, Inc., for the Federal Highway Administration Office of Policy Development, September 1996, <http://ntl.bts.gov/lib/5000/5800/5807/growth.pdf>.
- 27 Nicholas Crafts, "Transport Infrastructure Investment: Implications for Growth and Productivity," *Oxford Review of Economic Policy*, vol. 25, no. 3 (2009): 327–43.

- 28 Shirley and Winston, “Firm Inventory Behavior.”
- 29 Theofanis Mamuneas and Ishaq Nadiri, “Production, Consumption and Rates of Return to Highway Infrastructure Capital,” preliminary draft, August 2006, https://editorial.express.com/cgi-bin/conference/download.cgi?db_name=IIPF62&paper_id=11.
- 30 Ibid.
- 31 Crafts, “Transport Infrastructure Investment,” citing John Fernald, “Roads to Prosperity? Assessing the Link Between Public Capital and Productivity,” *American Economic Review*, vol. 89 (1999): 619–38. TFP, a measure of aspects of an economy’s total output that are not the result of inputs (land, labor, and capital), in effect indicates an economy’s long-term technological dynamism in terms of technical progress, technical efficiency, scale effects, and allocative efficiency.
- 32 Ibid.
- 33 T. R. Lakshmanan, “The Wider Economic Benefits of Transportation: An Overview,” Discussion Paper 2007-8, OECD Joint Transport Working Center, December 2007, www.internationaltransportforum.org/jtrc/DiscussionPapers/DiscussionPaper8.pdf; Alfred Marshall first observed that the benefits of density and specialization applied to businesses within the same industry as well as cities; see Alfred Marshall, *Principles of Economics* (New York: Macmillan, 1890).
- 34 Congressional Budget Office, “Appendix C: How Changes in Economic Projections Can Affect Budget Projections,” in “The Budget and Economic Outlook: Fiscal Years 2010 to 2020,” January 2010, www.cbo.gov/ftpdocs/108xx/doc10871/01-26-Outlook.pdf.
- 35 National Surface Transportation Policy and Revenue Study Commission, “Transportation for Tomorrow,” Final Report, December 2007, www.transportationfortomorrow.com/final_report/pdf/final_report.pdf; National Surface Transportation Infrastructure Financing Commission, “Paying Our Way: A New Framework for Transportation Finance,” Final Report, February 2009, http://financecommission.dot.gov/Documents/NSTIF_Commission_Final_Report_Advance_percent20Copy_Feb09.pdf; Robert Puentes, “A Bridge to Somewhere: Rethinking American Transportation for the 21st Century,” Brookings Metropolitan Policy Program, June 2008, www.brookings.edu/~media/Files/rc/reports/2008/06_transportation_puentes/06_transportation_puentes_report.pdf; Transportation for America, “The Route to Reform: Blueprint for a 21st-Century Federal Transportation Program,” 2009, http://t4america.org/docs/blueprint_full.pdf; National Transportation Policy Project, “Performance Driven: A New Vision for U.S. Transportation Policy,” Bipartisan Policy Center, June 2009, www.bipartisanpolicy.org/sites/default/files/NTPP_percent20Report.pdf; David R. Goode, “Well Within Reach: America’s New Transportation Agenda,” paper presented at National Transportation Policy Conference, Miller Center of Public Affairs, University of Virginia, Charlottesville, October 2010, http://web1.millercenter.org/conferences/report/conf_2009_transportation.pdf.

CHAPTER 2

- 1 Robert Puentes, “A Bridge to Somewhere: Rethinking American Transportation for the 21st Century,” Brookings Metropolitan Policy Program, June 2008, www.brookings.edu/~media/Files/rc/reports/2008/06_transportation_puentes/06_transportation_puentes_report.pdf.

- 2 Miller Center of Public Affairs, "Well Within Reach: America's New Transportation Agenda," October 2010, http://web1.millercenter.org/conferences/report/conf_2009_transportation.pdf.
- 3 National Transportation Policy Project, "Performance Driven: A New Vision for U.S. Transportation Policy," Bipartisan Policy Center, June 2009, www.bipartisanpolicy.org/sites/default/files/NTPP_percent20Report.pdf.
- 4 National Surface Transportation Infrastructure Financing Commission, "Paying Our Way: A New Framework for Transportation Finance," Final Report, February 2009, http://financecommission.dot.gov/Documents/NSTIF_Commission_Final_Report_Advance_percent20Copy_Feb09.pdf.
- 5 Puentes, "Bridge to Somewhere"; National Surface Transportation Policy and Revenue Study Commission, "Transportation for Tomorrow," Final Report, December 2007, www.transportationfortomorrow.com/final_report/pdf/final_report.pdf; National Surface Transportation Infrastructure Financing Commission, "Paying Our Way"; National Transportation Policy Project, "Performance Driven"; Miller Center for Public Affairs, "Well Within Reach."
- 6 Amanda Little, *Power Trip: The Story of America's Love Affair with Energy* (New York: HarperPerennial, 2010), 99.
- 7 The Intermodal Surface Transportation Efficiency Act of 1991 Public Law 102-240.
- 8 These titles include I, Federal-Aid Highways; II, Highway Safety; III, Public Transportation; IV, Motor Carrier Safety; V, Research; VI, Transportation Planning and Project Delivery; VII, Hazardous Materials Transportation; VIII, Transportation Discretionary Spending Guarantee; IX, Rail Transportation; X, Miscellaneous Provisions; and XI, Highway Reauthorization and Excise Tax Simplification.
- 9 Titles VI, VII, VIII, X, and XI of SAFETEA-LU do not address programmatic funding levels. The individual research programs in Title V are consolidated into a single title-specific program funding level. Of those titles considered in this analysis, small programs were removed that were (1) under \$1 million average annual authorization; (2) only authorized for one or two years, and/or; (3) sub-set-asides within a program set-aside. In Title I, 42 programs were not included in the analysis; and in Title II, 3 programs were removed.
- 10 In spite of the removal of programs, both Title I and Title II continue to dominate transportation funding. Title I, Highways, which is the largest of the titles, contains 63 individual programs and almost \$200 billion over the life of the law. This compares with \$3 billion in Title II, Safety, and \$45 billion in Title III, Public Transportation. Altogether, these programs include six years of authorized funding totaling almost \$200 billion and average annual funding of \$515 million. This is different from published funding levels due to the removed programs, set-asides, and sub-set-asides, as well as earmarks for the sake of analysis.
- 11 David Walker, *Comeback America: Turning the Country Around and Restoring Fiscal Responsibility* (New York: Random House Digital, 2010), 166–67. Assessment criteria include: program intent, funding source, core programs, program distribution type, distribution formula, era first authorized, administrative oversight, FY 2005–FY 2009 authorization, and total funding authorized. U.S. Code references and SAFETEA-LU section references were also considered for each program.
- 12 Programs in the "other" category encompass research, enforcement, and technology. With respect to authorized funding levels, capacity programs also received the largest

share of federal funds—fully 61 percent or \$155 billion is dedicated to programs with projects to increase the extent of the system as their focus. This is followed by repair and safety programs, at \$80 billion and \$11 billion, respectively.

- 13 U.S. Government Accountability Office, *Clear Federal Role and Criteria-Based Selection Process Could Improve Three National and Regional Infrastructure Programs* (Washington, D.C.: U.S. Government Printing Office, 2009).
- 14 23 USC 103(b)(6).
- 15 Federal Highway Administration, *Financing Federal Aid Highways*, Publication FHWA-PL-07-017 (Washington, D.C.: U.S. Government Printing Office, 2007).
- 16 23 USC 106(a) and 106(c).
- 17 23 USC Section 145.
- 18 U.S. Government Accountability Office, *Opportunities for Improving the Oversight of DOT's Research Programs and User Satisfaction with Transportation Statistics*, GAO 06-917 (Washington, D.C.: U.S. Government Printing Office, 2006).
- 19 In recent years, however, congressional earmarking has limited the use of competitive selection in the discretionary programs.
- 20 U.S. Department of the Treasury, "An Economic Analysis of Infrastructure Investment," October 11, 2010, www.treasury.gov/resource-center/economic-policy/Documents/infrastructure_investment_report.pdf.
- 21 U.S. Government Accountability Office, *Principles Can Guide Efforts to Restructure and Fund Federal Programs*, GAO 08-744T (Washington, D.C.: U.S. Government Printing Office, 2008).
- 22 Costas Panagopoulos and Joshua Schank, *All Roads Lead to Congress* (Washington, D.C.: CQ Press, 2008).
- 23 The HTF is divided into two accounts—the Mass Transit Account and the Highway Account. Some transportation programs are solely funded through the HTF, some with a combination of trust funds and general funds, and some solely through general funds. Because the majority of programs funded through Title I, Highways, are also funded through the Highway Account, the largest number of programs are funded through the Highway Account. The Mass Transit Account—which was created in 1982—is firewalled from the Highway Account and reserved for programs authorized under Title III, Public Transportation. Although the account receives 2.86 cents of the current 18.4 cent federal gas tax, it also receives between 19 and 20 percent of funding from general funds each year.
- 24 U.S. Government Accountability Office, *Nearly All States Received More Funding Than They Contributed in Highway Taxes Since 2005*, GAO-10-780 (Washington, D.C.: U.S. Government Printing Office, 2010).
- 25 See U.S. Congressional Committee on Transportation and Infrastructure, "Member-Designated Surface Transportation High Priority Project Reform Principles," Majority Staff Report, April 9, 2009; and Senate Appropriations Committee Policy on Earmarks, March 11, 2010.
- 26 U.S. Government Accountability Office, *Statewide Transportation Planning*, GAO-11-77 (Washington, D.C.: U.S. Government Printing Office, 2010).

- 27 Transportation Research Board, Future Financing Options to Meet Highway and Transit Needs, Project 20-24(49), National Cooperative Highway Research Program, December 2006.
- 28 National Surface Transportation Policy and Revenue Study Commission, "Transportation for Tomorrow."
- 29 National Surface Transportation Infrastructure Financing Commission, "Paying Our Way."
- 30 Panagopoulos and Schank, *All Roads Lead to Congress*.
- 31 U.S. Department of Transportation website, www.dot.gov/about.html.
- 32 Charles M. Farmer, "Injury Prevention," *BMJ Specialist Journals*, vol. 11: 18–23.
- 33 Cambridge Systematics, "Crashes vs. Congestion: What's the Cost to Society?" March 2008.
- 34 Robert D. Bullard, *Environmental Justice in the Twenty-First Century: The Quest for Environmental Justice* (San Francisco: Sierra Club Books, 2005).
- 35 Texas Transportation Institute, "2010 Urban Mobility Report," January 2011.
- 36 American Association of State Highway and Transportation Officials, "Unlocking Freight," 2010.
- 37 American Public Transportation Association, "Expanding the Transportation Options in an Aging Society," 2006.
- 38 U.S. Census Bureau, "Future Projections," 2000.
- 39 Scott Bernstein, "Redefining Affordability," Center for Neighborhood Technology, January 27, 2010.
- 40 Federal Highway Administration, "2008 Conditions and Performance Report."
- 41 American Society of Civil Engineers, "Report Card for America's Infrastructure 2009," available at www.infrastructurereportcard.org.

CHAPTER 3

- 1 White House, "Remarks by the President in the State of the Union Address," January 25, 2011, www.whitehouse.gov/the-press-office/2011/01/25/remarks-president-state-union-address.
- 2 Hart Research Associates and Public Opinion Strategies, "The Rockefeller Foundation Infrastructure Survey," gives findings from a national survey of registered voters conducted from January 29 to February 6, 2011, www.rockefellerfoundation.org/uploads/files/80e28432-0790-4d42-91ec-afb6d11febee.pdf.
- 3 Ibid.
- 4 Ibid.

- 5 Ibid.
- 6 Miller Center of Public Affairs. "Well Within Reach: America's New Transportation Agenda," http://web1.millercenter.org/conferences/report/conf_2009_transportation.pdf.
- 7 Though not the topic of this report, the Aviation Trust Fund also appears to be on the path to insolvency. See www.gao.gov/mobile/products/GAO-11-358T.
- 8 U.S. Government Accountability Office, "Restructured Federal Approach Needed for More Focused, Performance-Based, and Sustainable Programs," March 2008, www.gao.gov/new.items/d08400.pdf.
- 9 National Surface Transportation Policy and Revenue Study Commission, "Transportation for Tomorrow," January 2008, www.mtc.ca.gov/news/NSTPRSC/nstprsc_exec_summ.pdf.
- 10 U.S. Department of Commerce, cited by *Journal of Commerce*, January 2011; deficit figures: \$46.3 billion trade deficit, of which \$34.9 billion was oil imports (highest since 2008) means that oil was 75 percent of the trade deficit in January 2011.
- 11 McKinsey Global Institute, "Growth and Renewal in the United States: Retooling America's Economic Engine," February 2011.
- 12 U.S. Census Bureau, "US Interim Projections by Age, Sex, Race, and Hispanic Origin," March 2004, www.census.gov/ipc/www/usinterimproj.
- 13 According to the World Bank's "World Development Indicators," the U.S. growth rate is 0.9 percent, and China's is 0.5 percent.
- 14 "The Cracks are Showing," *Economist*, June 26, 2008, www.economist.com/node/11636517; "Building BRICs of Growth," *Economist*, June 5, 2008, www.economist.com/node/11488749.
- 15 Bruce Katz, Mark Muro, and Jennifer Bradley, "Miracle Mets," Brookings Institution, 2009.
- 16 Bureau of Economic Analysis, November 2007, www.bea.gov/about/pdf/panek_gdp_by_metro_area.pdf.
- 17 Katz and his colleagues find that the largest 100 metropolitan areas produced 78 percent of all patents, attracted 80 percent of National Institutes of Health and National Science Foundation research funding, and received 94 percent of all venture capital funding in 2005. Similarly, metros are the crucial stewards of U.S. human capital, as they encompass two-thirds of major U.S. research universities, 72 percent of adults with a postsecondary degree, and 75 percent of workers with graduate degrees. Katz, Muro, and Bradley, "Miracle Mets."
- 18 Infrastructure is a key source of connectivity among all other components within a complex global economy. The transportation of people, services, and goods, water, waste, technology, and energy are interconnected in significant and often nonlinear ways, with consequences ranging from the local to the global. Thus, their alignment can generate benefits that can have a multiplier effect on economic growth and quality-of-life improvements. Our future transportation system should respond to the interdependence of this network dynamic by providing redundancy, resilience, and reliability.
- 19 For example, see Jeffrey L. Western and Bin Ran, *Information Technology in Transportation: Key Issues and a Look Forward*, Committee on Information Systems and Technology. <http://onlinepubs.trb.org/onlinepubs/millennium/00054.pdf>.

- 20 Edward Glaeser, *The Triumph of Cities: How Our Greatest Invention Makes Us Richer, Smarter, Greener, Healthier, and Happier* (New York: Penguin Press, 2011).
- 21 Gerald Carlino, Satyajit Chatterjee, and Robert Hunt, *Matching and Learning in Cities: Urban Density and the Rate of Invention*, Working Paper 04-16/R (Philadelphia: Federal Reserve Bank of Philadelphia, 2005), www.philadelphiafed.org/research-and-data/publications/working-papers/2004/wp04-16R.pdf.
- 22 Bert Van Wee, "The New Dutch Per-Kilo-Metre Driving Tax," CESifo DICE Report, vol. 8, no. 2 (2010), www.cesifo-group.de/DocCIDL/dicereport210-rm1.pdf.
- 23 Federica Genovese et al., "China and Green Transportation," Paul H. Nitze School of Advanced International Studies, Johns Hopkins University, May 2010, [http://saistrip2010.webatu.com/China percent20and percent20Green percent20Transportation.pdf](http://saistrip2010.webatu.com/China%20percent20and%20percent20Green%20percent20Transportation.pdf).
- 24 Policy tools for bus rapid transit systems include bus-dedicated traffic lanes, unique routing systems, and integrated payment systems. See David Hensher and Thomas Golob, "Bus Rapid Transit Systems: A Comparative Analysis," *Transportation Journal*, vol. 35, no. 4 (2008): 501–18.
- 25 Deborah Gordon and Dan Sperling, *Two Billion Cars: Driving Toward Sustainability* (New York: Oxford University Press, 2009).
- 26 Oak Ridge National Laboratory, *Transportation Energy Databook: Edition 29*, July 2010, http://cta.ornl.gov/data/tebd29/Edition29_Chapter08.pdf.
- 27 Transportation for America, "Smart Mobility for a 21st Century America," white paper, October 2010.
- 28 These measurements are based upon the "core-based statistical area" (CBSA) methodology utilized by the Office of Management and Budget. "Metropolitan" is defined as a census-based urban cluster with more than 50,000 people. "Micropolitan" is defined as a census-based urban cluster with between 10,000 and 50,000 people. All others are labeled as outside the CBSA. Those populations labeled "outside CBSA" include, but are not exclusively made up of, rural populations. U.S. Census Bureau, "Statistical Abstract of the United States: 2011 (130th Edition)," 2010, www.census.gov/compendia/statab.
- 29 Christopher Leinberger and Patrick Doherty, "The Next Real Estate Boom," *Washington Monthly*, November 2010, http://www.brookings.edu/articles/2010/11_real_estate_leinberger.aspx.
- 30 U.S. Census Bureau, "Future Projections," 2000.
- 31 American Public Transportation Association, "Expanding the Transportation Options in an Aging Society," 2006, www.publictransportation.org/pdf/reports/aging_options.pdf.
- 32 See U.S. Department of Transportation, Federal Highway Administration, Asset Management, "Economic Analysis Primer: Benefit-Cost Analysis," www.fhwa.dot.gov/infrastructure/asstgmt/primer05.cfm.
- 33 Currie, Graham, Evan Gwee, John Stanley. "Exploring International Variation in Cost-Benefit Analysis Guidelines for Urban Rail Project Evaluation – Impact on Project Outcomes," Transportation Research Board Paper 11-0735, January 2011.
- 34 Airlines, which are essentially privatized transportation, have a practice of effective pricing very. They price peak times much higher and use price differentials to route travelers through facilities that are underused.

35 For example, see www.avego.com.

36 Reid Ewing et al., *Growing Cooler: The Evidence on Urban Development and Climate Change* (Washington, D.C.: Urban Land Institute, 2008).

37 For more, see Peter Nijkamp and Hugo Priemus, *The Future of Intermodal Transport* (Northampton, Mass.: Edward Elgar, 2008); Gergana Dimitrova, and Gerrit Stratmann, eds., *Automotive Clustering in Europe: Case Studies on Cluster Management and Development* (Wiesbaden: Hessen Agentur, 2008); and *European Commission, Hamburg: European Green Capital 2011* (Brussels: European Commission, 2010), http://ec.europa.eu/environment/europeangreencapital/green_cities_submenu/awardwinner_2011.html.

38 Hart Research Associates and Public Opinion Strategies, "Rockefeller Foundation Infrastructure Survey."

39 Ibid.

40 Jad Mouawad, "US Economy Is Better Prepared for Rising Gas Costs," *New York Times*, March 8, 2011, www.nytimes.com/2011/03/09/business/economy/09gasoline.html.

CHAPTER 4

- 1 U.S. Department of the Treasury and Council of Economic Advisers, "An Economic Analysis of Infrastructure Investment," October 11, 2010, www.treasury.gov/resource_center/economic-policy/Documents/infrastructure_investment_report.pdf.
- 2 Energy Information Agency, "Transportation Energy Data Book"; RAND Corporation, "The Option of an Oil Tax to Fund Transportation and Infrastructure," 2011.
- 3 U.S. Public Interest Research Group, "Do Roads Pay for Themselves? Setting the Record Straight on Transportation Funding," January 2011.
- 4 Federal Highway Administration, *Financing Federal Aid Highways*, Publication FHWA-PL-07-017 (Washington, D.C.: U.S. Government Printing Office, 2007).
- 5 Kate Gordon (Apollo Alliance), "Transportation Spending in the US," October 13, 2008, <http://apolloalliance.org/rebuild-america/data-points-energy-efficiency/data-points-transportation-spending-in-the-us>.
- 6 Gasohol rates are not shown. Gasohol was not defined in federal law until 1979, when it was first blended in gasoline at 10 percent by volume alcohol. This excludes alcohol made from fossil fuels. There have been intermittent periods when gasohol was exempt from taxation. The gasohol tax is set at 13.3 cents per gallon.
- 7 Ian W. H. Parry, "Is Pay As You Drive Insurance a Better Way to Reduce Gasoline Than Gasoline Taxes?" *Resources for the Future*, April 2005.
- 8 Second Nature, "Education for Sustainability," www.secondnature.org/documents/TF_Recs_2010-05-06.pdf.
- 9 Fuel-cycle emissions consider all parts of the transportation chain that use energy and produce emissions. Also termed "well-to-wheel" emissions, fuel-cycle emissions start at

the wellhead, where fuel is extracted, and end at the tailpipe, where emissions emerge after fuel is combusted in a vehicle engine. Vehicle disposal is sometimes added into fuel-cycle emissions.

- 10 Oak Ridge National Laboratory, Transportation Energy Databook: Edition 29, table 1.13, 2010. The alcohol fuels (corn ethanol) blended into gasoline to make gasohol (10 percent ethanol or less) are counted under “renewables” and are not included in the petroleum share.
- 11 Fleet turnover is estimated at more than ten to fifteen years, but a portion of vehicles that are twenty years and older are expected to remain on the road as durability has increased in recent years.
- 12 Michael Wang, “Well-to-Wheels Greenhouse Gas Emissions of Alternative Fuels,” Argonne National Laboratory, 2007.
- 13 Deborah Gordon, “The Role of Transportation in Driving Climate Disruption,” Carnegie Paper, Carnegie Endowment for International Peace, December 2010.
- 14 CO₂ is not the only emission—others include carbon, carbon oxide, unburned carbon (PM/BC), methane (CH₄), and others.
- 15 There is a small portion of the fuel that is not oxidized into CO₂ when the fuel is burned. EPA has published information on CO₂ emissions from gasoline and diesel, taking the oxidation factor into account based on the carbon content used in EPA’s fuel economy analysis.
- 16 Environmental Protection Agency, “Emission Facts: Average Carbon Dioxide Emissions Resulting from Gasoline and Diesel Fuel,” February 2009; additional resources are available at www.epa.gov/OMS.
- 17 NASA and Nadine Unger et. al., www.pnas.org/content/early/2010/02/02/0906548107.full.pdf+html and <http://www.energybulletin.net/node/51744>.
- 18 Urban Design 4 Health, Inc., February 2010; American Public Health Association and Federal Highway Administration, *The Hidden Health Costs of Transportation* (Washington, D.C.: U.S. Government Printing Office, 2000); addendum to the 1997 Federal Highway Cost Allocation Study Final Report, May 2000, www.fhwa.dot.gov/policy/hcas/addendum.htm (adjusted to 2008 dollars).
- 19 Jonathan Patz, presentation for EESI Congressional Briefing, May 24, 2010; Michael S. Friedman, Kenneth E. Powell, Lori Hutwagner, LeRoy M. Graham, and W. Gerald Teague, (2001). “Impact of Changes in Transportation and Commuting Behaviors During the 1996 Summer Olympic Games in Atlanta on Air Quality and Childhood Asthma,” *Journal of the American Medical Association*, vol. 285, no. 7 (2001): 897–905.
- 20 World Meteorological Association, “Current Extreme Weather Events,” August 11, 2010, www.wmo.int/pages/mediacentre/news/extremeweathersequence_en.html.
- 21 National Center for Atmospheric Research, November 12, 2009, www2.ucar.edu/news/record-high-temperatures-far-outpace-record-lows-across-us.
- 22 Martin Parry et. al., “Assessing the Costs of Adaptation to Climate Change, International Institute for Environment and Development, August 2009, <http://pubs.iied.org/pdfs/115011IED.pdf>.
- 23 Frank Ackerman, Elizabeth Stanton, Chris Hope, and Stephane Alberth, “Did the Stern Review Underestimate US and Global Climate Damages?” *Energy Policy*, vol. 37, no. 7 (2009): 2717–21.

- 24 National Surface Transportation Policy and Revenue Study Commission, "Transportation for Tomorrow," Final Report, December 2007, www.transportationfortomorrow.com/final_report/pdf/final_report.pdf.
- 25 Reid Ewing et al., *Growing Cooler: The Evidence on Urban Development and Climate Change* (Washington, D.C.: Urban Land Institute, 2008). See also the Transportation Index for Sustainable Places, under development by Norman Garrick, associate professor of civil and environmental engineering at the University of Connecticut, www.planetizen.com/node/46367.
- 26 National Surface Transportation Policy and Revenue Study Commission, "Transportation for Tomorrow." For similar examples of how inaccurate pricing creates inefficiency, see Rod Eddington, *The Eddington Transport Study* (London: Her Majesty's Stationery Office, 2006).
- 27 U.S. Department of Transportation, *Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance* (Washington, D.C.: U.S. Government Printing Office, 2008).
- 28 Joseph Cortright, *Measuring Urban Transportation Performance: A Critique of Mobility Measures and A Synthesis* (Chicago: CEOs for Cities, 2010).
- 29 Reconnecting America analysis of National Household Travel Survey data.
- 30 Scott Bernstein, Carrie Makarewicz, and Kevin McCarty, *Driven to Spend: Pumping Dollars Out of Our Households and Communities* (Chicago: Center for Neighborhood Technology, 2005).
- 31 U.S. Bureau of the Census, Foreign Trade Division, January 2011, www.census.gov/foreign-trade/Press-Release/current_press_release/exh17.txt; U.S. Bureau of the Census, "Statistical Abstract of the US, 2011, Table 1299," <http://www.census.gov/compendia/statab/2011/tables/11s1299.pdf>.
- 32 U.S. Energy Information Administration, "US Imports by Country of Origin," February 25, 2011, www.eia.doe.gov/dnav/pet/pet_move_impcus_a2_nus_ep00_im0_mbbldpd_m.htm; U.S. Department of State, "Travel Warnings," March 11, 2011, travel.state.gov/travel/cis_pa_tw/tw/tw_1764.html.
- 33 Anne Korin (co-director of the Institute for the Analysis of Global Security), "Rising Oil Prices, Declining National Security," testimony before the House Committee on Foreign Affairs, May 2008.
- 34 RAND Corporation, "Option of an Oil Tax."
- 35 Texas Transportation Institute, 2010 Annual Urban Mobility Report, http://mobility.tamu.edu/ums/media_information/press_release.stm.
- 36 Joseph Cortright, *Driven Apart: How Sprawl Is Lengthening Our Commutes and Why Misleading Mobility Measures Are Making It Worse* (Chicago: CEOs for Cities, 2009).
- 37 Urban Design 4 Health, Inc., February 2010; American Public Health Association and Federal Highway Administration, *Hidden Health Costs of Transportation*; S. Keehan et al., "Health Spending Projection Through 2017," Health Affairs, Web Exclusive W146:21, February 28, 2008.
- 38 Urban Design 4 Health, Inc., February 2010; American Public Health Association and Federal Highway Administration, *Hidden Health Costs of Transportation; AAA, Crashes vs. Congestion Report: What's the Cost to Society?* (Cambridge, Mass.: Cambridge

- Systematics, 2008), www.aaanewsroom.net/assets/files/20083591910.crashesVscongestionfullreport2.28.08.pdf (adjusted to 2008 dollars).
- 39 Upstream Public Health, Health Impact Assessment on Policies Reducing Vehicle Miles Traveled in Oregon Metropolitan Areas (Portland: Upstream Public Health, 2009), www.upstreampublichealth.org/newsroom?type=reports; William H. Lucy, "Mortality risk associated with leaving home: Recognizing the relevance of the built environment," *American Journal of Public Health*, 93(9), (2003): 1564–69. Reid Ewing, Richard A. Schieber, and Charles V. Zegeer, "Urban sprawl as a risk factor in motor vehicle occupant and pedestrian fatalities," *American Journal of Public Health*, 93(9), (2003): 1541–45; Laurie F. Beck, Leonard J. Paulozzi, and Stephen C. Davidson, "Pedestrian fatalities, Atlanta metropolitan statistical area and United States, 2000–2004," *Journal of Safety Research*, 38, (2007): 613–16; Leonard J. Paulozzi, "Is it safe to walk in the Sunbelt? Geographic variation among pedestrian fatalities in the United States, 1999–2003," *Journal of Safety Research*, 37, (2006): 453–59.
- 40 Upstream Public Health, Health Impact Assessment; Daniel Schefer and Piet Rietvald, "Congestion and safety on highways: Towards an analytical model," *Urban Studies*, 34(4), (1997): 679–92; Gordon R. Lovegrove and Tarek Sayed, "Macro-level collision prediction models for evaluating neighbourhood traffic safety," *Canadian Journal of Civil Engineering*, 33, (2006): 609–21.
- 41 Urban Design 4 Health, Inc., February 2010; American Public Health Association and Federal Highway Administration, Hidden Health Costs of Transportation; R. Sturm, "The Effects of Obesity, Smoking, and Drinking on Medical Problems and Costs," *Health Affairs*, March–April 2002, 245–53; Rails to Trails Conservancy, *Active Transportation for America* (Washington, D.C.: Rails to Trails Conservancy, 2008); Centers for Disease Control and Prevention, "Overweight and Obesity: Economic Consequences," 2007; Michael Pratt et al., "Higher Direct Medical Costs Associated with Physical Inactivity," *Physician Sports Medicine*, 2000.
- 42 Urban Design 4 Health, Inc., February 2010; American Public Health Association and Federal Highway Administration, Hidden Health Costs of Transportation; National Institutes of Health and National Institute of Diabetes and Digestive and Kidney Diseases, "Statistics Related to Overweight and Obesity: The Economic Costs," <http://win.niddk.nih.gov/statistics/index.htm>.
- 43 Upstream Public Health, Health Impact Assessment; Fuzhong Li, Peter A. Harmer, Bradley J. Cardinal, Mark Bosworth, Alan Acock, Deborah Johnson-Shelton, and Jane M. Moore, "Built environment, adiposity, and physical activity in adults aged 50–75 years," *American Journal of Preventive Medicine*, 35(1), (2008): 38–46. Ryuichi Kitamura, Patricia L. Mokhtarian, and Laura Laidet, "A micro-analysis of land use and travel in five neighborhoods in the San Francisco Bay Area," *Transportation*, 24, (1997): 125–58; Christine M. Hoehner, Laura K. Brennan Ramirez, Michael B. Elliot, Susan L. Handy, and Ross C. Brownson, "Perceived and objective environmental measures and physical activity among urban adults," *American Journal of Preventive Medicine*, 28(2S2), (2005): 105–16; Gavin R. McCormack, Billie Giles-Corti, and Max Bulsara, "The relationship between destination proximity, destination mix and physical activity behaviors." *Preventive Medicine*, 46, (2008): 33–40.
- 44 Upstream Public Health, Health Impact Assessment; Ryan D. Edwards, "Public transit, obesity, and medical costs: Assessing the magnitudes," *Preventive Medicine*, 46, (2008): 14–21; Lilah M. Besser and Andrew L. Dannenberg, "Walking to public transit: Steps to help meet physical activity recommendations," *American Journal of Preventive Medicine*, 29(4), (2005): 273–80; Karen Villanueva, Billie Giles-Corti, and Gavin McCormack, "Achieving 10,000 steps: A comparison of public transport users and drivers in a university

setting," *Preventive Medicine*, 47, (2008): 338–41; Richard E. Wener, and Gary W. Evans, "A morning stroll: Levels of physical activity in car and mass transit commuting," *Environment and Behavior*, 39(1), (2007): 62–74; Anne Vernez Moudon, Chanam Lee, Allen D. Cheadle, Cheza Garvin, Donna Johnson, Thomas L. Schmid, and Robert D. Weathers, "Attributes of environments supporting walking," *American Journal of Health Promotion*, 21(5), (2007): 448–59.

45 Maggie Grabow, Micah Hahn, and Melissa Whited, "Valuing bicycling's economic and health impacts in Wisconsin. Estimating the value of bicycling to tourism and health in Wisconsin and reviewing the potential to increase that value in the face of changing demographics, lifestyles, and economy," report prepared for Representative Spencer Black as part of a CHANGE Capstone Experience project, Nelson Institute for Environmental Studies Center for Sustainability and the Global Environment, University of Wisconsin–Madison, 2010.

46 Daniel J. Graham, "Agglomeration Economies and Transport Investment," in *The Wider Economic Benefits of Transport: Macro-, Meso-, and Micro-Economic Transport Planning and Investment Tools* (Paris: Organization for Economic Cooperation and Development, 2008).

47 Ibid.

48 Roman Trubka, *Productivity and the Density of Economic Activity: Preliminary Estimates of Agglomeration Benefits in Australian Cities* (Perth: Curtin University, 1996).

49 Alan Berube, Elizabeth Deakin, and Steven Raphael, "Socioeconomic Differences in Household Automobile Ownership Rates: Implications for Evacuation Policy," Goldman School of Public Policy, University of California, Berkeley, June 2006, <http://gsppi.berkeley.edu/faculty/sraphael/berubedeakenraphael.pdf>.

CHAPTER 5

- 1 Edward Regan, "Tolling the Interstates: Ed Regan," *Public Works Financing Newsletter*, vol. 258, March 2011. Two and a half trillion dollars may be conservative. Other sources put the estimated cost for Interstate Highway System rehabilitation over the next fifty years at \$3 trillion. National Cooperative Research Program, Transportation Research Board, "Future Options for the National System of Interstate and Defense Highways," Task 10 Final Report, May 2007.
- 2 The federal government does own and operate a system of locks and dams on the inland waterway system, but this transportation system has its own set of user fees and its own trust fund.
- 3 The European Union, which comprises most of the members of Organization for Economic Cooperation and Development, imports more than 90 percent of the oil it consumes.
- 4 OECD and European Environment Database, "Database on Instruments Used for Environmental Policy and Natural Resources Management," updated March 1, 2011, www2.oecd.org/econinst/queries/index.htm.

- 5 This is based on an average current cost of gasoline of \$3.50 per gallon and total federal and state gas taxes of 45 cents per gallon.
- 6 Organization for Economic Cooperation and Development, “More Information.”
- 7 Danish Energy Agency (EnergiStyrelsen), “The Danish example—the way to an energy efficient and energy friendly economy,” Policy Paper, February 2009, www.ens.dk/en-US/policy/danish-climate-and-energy-policy/behind-the-policies/TheDanishExample%20Engelsk%20FINAL%200209%20vs2_final.pdf.
- 8 Organization for Economic Cooperation and Development, “More Information.”
- 9 Ibid.
- 10 This is using West Texas Intermediate as the measure of the world price of oil.
- 11 One variable not accounted for is how much higher oil prices will reduce total oil consumption. Though higher oil prices will inevitably depress demand for oil, this shortfall will at least partially be covered by the higher ad valorem tax per barrel. If oil consumption is reduced to the point of significantly depressing transportation trust fund balances (a good outcome toward the goal of reducing reliance on foreign oil), the abatement of the gas tax can be suspended until minimum transportation trust fund balances are restored.
- 12 David L. Greene and Janet L. Hopson, “The Costs of Oil Dependence 2009,” Oak Ridge National Laboratory Memorandum, 2010.
- 13 In July 2008, the price of oil hit \$147 per barrel. By January 2009, the price was \$38 per barrel. The housing and banking collapse in the fall of 2008 was not caused by these price swings, but they probably contributed to the severity of its impact.

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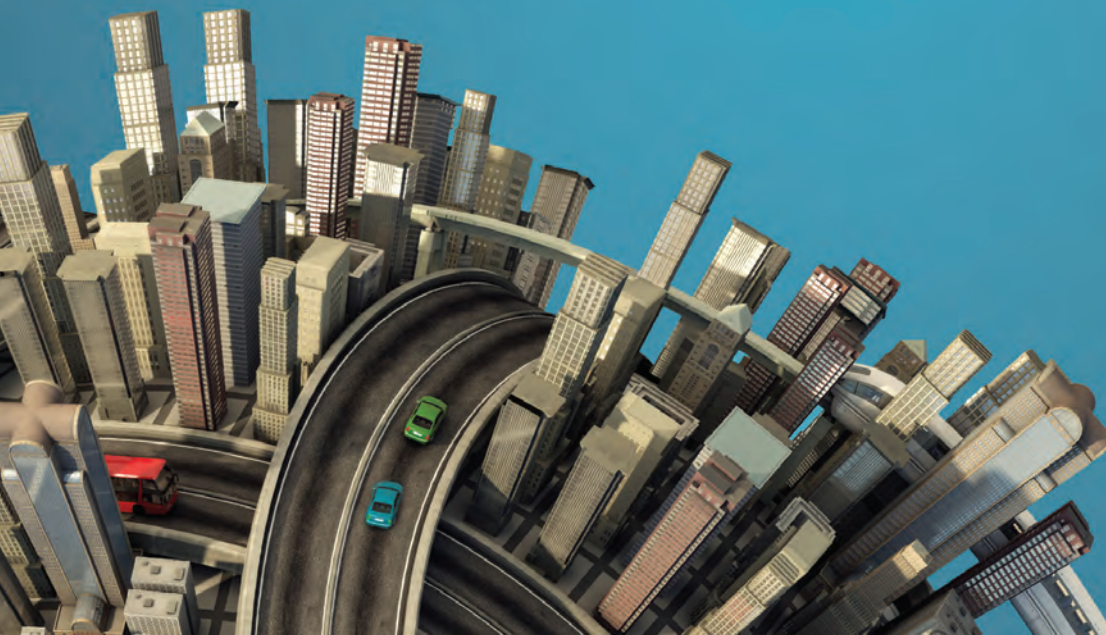
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