Unintended Effects of Federal Transportation Policy: A look at the Lifecycle Costs of the Interstate System

by

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ABSTRACT

The federal surface transportation program in the United States stands at a crossroads. Short on money and lacking vision, the program is in need of reevaluation and reform. This thesis attempts to illustrate the current issues affecting the program within the historical context of transportation system development and proposes a series of policy reforms to refocus the program. An analysis of the history of US transportation policy demonstrates ongoing persistent trends towards multimodal approaches, increased federal involvement and a shift in focus from rural development to enabling the growth of metropolitan economies. The analysis also shows how Congress has historically made significant progress when an over-arching vision can be connected to implementation mechanisms that provide new funding to broad constituencies in all fifty states. By positing a basic model utilizing infrastructure lifecycle costs to illustrate the dynamics of systematic infrastructure needs, the research demonstrates the added costs of past policies – particularly deferred maintenance – and the implications of current inaction. The research finds an estimated $7.2 billion dollar shortfall in annual funding on the Interstate system alone – mostly for reconstruction. Additionally, the results indicate a significant increase in annual system costs ($28.3 billion vs. $18.82 billion) under a regime of deferred maintenance as opposed to regular upkeep. Using this as a foundation, the balance of the work discusses the political argument in support of a federal role in system maintenance, recommends a series of policy reforms to address short and long term issues with the federal program and presents an overview of possible revenue streams to fund these changes. The thesis then recommends that a new national multimodal vision, focused on state of good repair and the opportunity to generate short-term construction jobs and long-term economic growth, can be the basis for successful reauthorization legislation.

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Introduction

Today, America's surface transportation program faces a series of unique challenges. The program – which helped to guide the rapid development of the nation's core highway system from the 1950's through the 1990's – now struggles to adequately fund the maintenance and cyclical reconstruction projects necessary to keep the system in a state of good repair. In addition, the effects of inflation, changes in automobile use, technological developments and the recent economic downturn have combined to erode the revenue-generating ability of the federal gas tax, leading to financial difficulties unprecedented in recent memory. However, crisis situations also provide an opportunity to break with current policy and to forge new political coalitions to tackle the most pressing problems of the day. Lawmakers and advocates, therefore, have an opportunity to use the upcoming transportation authorization cycle to think differently, addressing the core needs of the system, transcending existing political divisions and exploring bold new ideas.

In order to provide a foundation for future reforms, however, policymakers must adequately understand the historical development of the system and the needs of the present. The current problems affecting the federal program can largely be viewed as the result of a series of unintended consequences from a succession of policy decisions made – in many cases – a half-century ago. The current program carries on a legacy of sometimes wise, and sometimes ill-fated, choices that helped to define the historical development of transport systems in this nation. Notably, however – from particularly strict interpretations of the Constitution hindering early interstate cooperation, to policies facilitating construction of the nation's rail network, early 20th century initiatives to get the farmer out of the mud, the 1950s plan to fund the Interstate highway system, and the 1970s interventions to address urban roadways, transit, and rail projects –much of federal transportation policy in this nation has been reactive and incremental in nature.

In the early 1900's, urban roadway, public transport and railway systems functioned reasonably well and were largely adequate for the needs of the time. Rural citizens, however, were largely "stuck in the mud." Farm-to-market roads were barely existent or in poor shape in nearly every state in the nation. As a result, much of the earliest congressional action to provide funds for highway construction was targeted for rural development and used to subsidize the work of state highway departments. In the 1940's and 50's, the development of the Interstate Highway System built on this institutional model to create the largely-ubiquitous modern expressway system.

In the twenty-first century, now that the system is essentially complete and has since evolved to form the core of the modern American transportation system, access and mobility on a national scale has become largely dependent on the quality and the performance of this existing infrastructure. Even the effects of costly mega-projects (such as Boston's recently completed Big Dig), that continue to add to system length and capacity, prove exceedingly modest compared to the effects of the performance of the existing system. Therefore, it is of clear national concern that two significant problems, currently threatening to hinder system performance, be addressed:

1) **The Deterioration of Physical Infrastructure**
   The physical maintenance of the nation's highway network (and transit systems) suffers from disinvestment. As key infrastructure elements approach and exceed 50 years of age, a lack of adequate funds for their upkeep will significantly affect the quality and capacity of the system.
2) **Congestion**
   Growing levels of congestion and concomitant environmental impacts continue to affect the largest metropolitan areas in the United States – particularly the 52 areas with populations in excess of 1 million people[1].

These problems both have distinct and complex root causes requiring unique policy interventions. This work will focus on the first of these two issues – the deterioration of our nation's infrastructure – by attempting to get a better understanding of the costs that drive the current system. Equipped with this

[1] *Per 2008 population estimates.*

information, policymakers can then use that foundation to develop policy solutions to address those needs within the institutional and political framework that defines the transportation policy arena.

Specifically, this work will demonstrate that much of the burden of funding the federal-aid system – in particular, the Interstate system – can be traced back to the cyclical costs of resealing, resurfacing and reconstructing roadways constructed, in many cases, more than five decades years ago. By modeling the development of infrastructure costs for this key system, it is possible to illustrate how closely the government is addressing the needs of keeping our highways open and in good condition, evaluate ways to begin to meet those needs and target funding to where it can be the most efficacious. Political leaders and policymakers can then use that data to demonstrate the importance – to all regions of the country and to all of the states – of keeping our nation's highways (and public transport infrastructure) in a good state of repair. The following chapters provide an outline of how to learn from past experience, better understand the system that has been inherited and begin to more effectively respond to the system's most significant problems.

Significantly, at this moment, the transportation trust funds are near depletion, and Congress will need to address the question of increased taxation to support a sustainable policy – a difficult political challenge requiring a compelling national need to muster the political will for action. Simultaneously, the worst world economic downturn since the 1930s has caused renewed interest in infrastructure investment as a tool of economic stimulus. This thesis develops an approach intended to help policy makers deal successfully with this complex set of challenges.

The thesis recommends that a Federal role to finance and oversee the attainment of a state of good repair for highway and transportation systems throughout the 50 states can provide both the unifying national theme and the cost-effective use of Federal dollars, and which could provide both short-term stimulus and long-term sustained growth. It also recommends that a similar approach to addressing the issue of growing congestion could be incorporated into the same platform.

Chapter 1: How Has Federal Transportation Policy Evolved?

Introduction

Although it is often taken for granted, a healthy and robust transportation network is the lifeblood of a contemporary nation. A country the size and scale of the United States depends critically on reliable and robust avenues of commerce for its industrial strength and commercial growth. The system is crucial to a strong and competitive economy – ensuring the rapid movement of people and goods between farms and ports and suburbs and cities. Manufacturers rely on the transport system to acquire raw inputs and to deliver finished goods, the retail sector requires dependable shipments of manufactured products and easy access for potential customers, and the services sector relies on the transport network to ensure access to a large and increasingly specialized labor market.

The ability of the system to accomplish these demands is both in the private interest and for the public good. As such, it has been a long-established government responsibility to ensure that strong transportation links are established and preserved, either through direct action or through private partnership. The ancient Romans used public power to construct an extensive system of roads to connect their vast empire. Similarly, the Incan empire relied on mandatory support from its populace – including forced labor – to construct over 14,000 miles of trails and roads throughout the western coast of South America.

In the United States, though the roles and relationships have changed over time, the federal government, states, municipalities and private interests have all shared a responsibility for financing, regulating and providing a reliable transportation system. As the nation confronts the critical problems with current federal transportation policy with an eye towards significant reforms, it is useful to look back on the development of transportation policy over our nation's history.

Over the last two and a half centuries, this nation has experienced a variety of different policy regimes regarding the development of public infrastructure and our national transportation system. The system has transitioned from:

- Policy norms that largely eschewed federal involvement to a strong and ubiquitous federal role in the funding and development of the nations' highways
- Periods of almost exclusively private provision of mass transportation to the public sector provision of nearly all transit services
- Seemingly no federal involvement to periods of stringent industry-wide federal regulation of common-carrier rail, ship and air operations

The evolution of transport policy has been a tale of conflict, compromise and paradox. An investigation of the history and development of transportation policy in the US will give the reader perspective, will help to illuminate the development of the current paradigm, and will provide insight as to what elements of current policy need improvement.

Historical Development of Federal Transportation Policy

Colonial Roots

Colonial America, though gifted with a number of natural advantages, such as good harbors and a number of navigable inland waterways, from the start suffered from a lack of reliable interconnections. Early European settlements were generally established on islands, peninsulas or inland locations on rivers near the "fall line" to combine access to the ocean with the ability to utilize navigable inland waterways. The ocean, after all, provided the only route of communication and supply with the Old World and served as the only route of escape, should the conditions in the new colonies prove too inhospitable.[2]

[2] Ringwalt, J.L.. *Development of Transportation Systems in the United States*. Published by Author, Philadelphia, 1888. p. 8

All of the early settlements that we recall today as the historical roots for this nation were notable for their location along some of the most prominent geographic features of the Atlantic coast. Massachusetts Bay, Rhode Island and Narragansett Bay, the Lower Hudson River Valley, Delaware Bay and the Chesapeake Bay were all amongst the earliest established colonial settlements due to their natural harbors and access to inland waterways. Each of the thirteen original colonies had one or more seaports and the main current of trade was between the resource-rich hinterlands of each region on one hand, and the outside world over the seas on the other. Commerce between the colonies was originally of limited magnitude, and what did occur was mostly on moderate-sized oceangoing vessels. In fact, the first acts of governmental policymaking regarding transportation in what is now the United States were to enact legal regulations "relating to boats, canoes, and landings."[3]

As late as 1677, upon the arrival of William Penn at what is today Philadelphia, no provision for roads had been made in the mid-Atlantic colonies. What limited land travel was undertaken between settlements was on horseback along narrow, winding Indian trails. Rivers were either forded directly or, if they were too wide or too deep, crossed with the assistance of local Indians on canoe while the horse swam behind. This lack of reliable inter-colonial communication limited the scope and reach of each coastal town and port to its immediate vicinity, limiting growth and development. The extent to which these land routes were substituted and improved, in an effort to capture for each of the major seaports the largest share of internal and foreign trade itself characterized a significant element of the first hundred years of transportation development in America. [4]

Post-Revolutionary Development (1776 – 1820)

In the decades following the American Revolution, interstate commerce was still limited, and the majority of domestic goods and foreign imports continued to flow over the nation's inland and coastal waterways. The "serious attention of the advanced legislators and progressive minds of the United

[3] *Ibid.*
[4] *Ibid.* p. 9

States, shortly after the close of the American Revolution, was turned rather to the improvement of river, connections between rivers and water systems, than to improvements of roads."[5] Some limited federal involvement began, particularly in the realm of coastal navigation. For example, the first federal construction project under the U.S. Constitution was the construction of the Cape Henry Light at the mouth of Chesapeake Bay – the archetype for a series of congressionally funded lighthouses. Such action, however, represented the exception rather than the rule and was driven more by the influence of specific political constituencies than by any overarching strategy or national policy.

The responsibility for providing for surface transportation needs was, with few exceptions, largely a state and local matter. The sovereign states had the prerogative to construct roads, canals and to charter ferryboat lines in their respective territories and interstate connections were largely governed by direct agreements between the states involved.

In the early 1800's, however, some officials began to envision a more active role for the federal government. The nascent country was so deficient in reliable corridors of interstate transportation – with roads in some areas practically impassable several months of the year – that political disintegration of the new nation was feared. Acting on a Senate resolution, Secretary of the Treasury Albert Gallatin prepared an analysis, the *Report on Roads, Canals, Harbors and Rivers,* in 1808. In his report, the Secretary urged the national government to build a coordinated national system of public works including canals and post roads along the Atlantic seaboard and interior passages connecting the Atlantic with the "midwestern rivers" and the Great Lakes. Gallatin was among the first to advocate the principle that the federal government was responsible for taking the lead in projects of interstate transportation where "other actors lacked the ability, the resources, and the scope of action to accomplish the task." Gallatin himself stated that the construction of needed infrastructure could, more than any other action of the federal government "effectually tend to strengthen and perpetuate [the]

[5] *Ibid.*

Union." This sentiment regarding infrastructure development was largely shared by many of the nation's founders, including George Washington and Alexander Hamilton.

Specifically, Gallatin called for a series of four great canals along the Atlantic coast from New York City to South Carolina cutting across the principal capes and necks, a major turnpike from Maine to Georgia, a series of inland canals heading to Ohio, a canal crossing New York State connecting to the Great Lakes and improvements to make major rivers, including the Potomac, Susquehanna, James, and Santee, passable to navigation.[6] Though Gallatin's report stood as a far-sighted reflection of what would much later come to resemble federal policy, for much of the 1800's, the federal role in transportation funding and policy remained limited. For many decades, significant debate remained as to whether the federal government even had the constitutional authority to invest in public works. Much of this debate revolved around the same "states rights" vs. "federal authority" issue that both plagued and defined the early days of this nation – particularly regarding the question of slavery – eventually culminating in the Civil War.

In the meanwhile, the responsibility for making provisions for improvements to waterways and overland routes fell almost entirely to the states and private actors. Theoretically and legally there were relatively good provisions for road-building in most of the colonies, but the extent to which these regulations were followed was limited. Most states legally bound town or county residents or landowners either to provide for roads through or adjacent to their property or to pay a tax penalty which would be used to employ road builders. Enforcement, however, was lax at best. Road builders were generally farmers with little engineering skill and states often lacked the funds to provide local jurisdictions with adequate equipment and to pay wages for supplemental workers. As a result, under

[6] Shaw, Ronald E. *Canals for a Nation: The Canal Era in the United States, 1790-1860*. University Press of Kentucky, 1993.

these systems, very little work was done regarding material improvements to the road system from early colonial times through the eighteenth century.[8]

Even at this early time, however, Americans were fairly mechanically inclined. Ideas and technologies that were beginning to fuel the Industrial Revolution in Britain slowly trickled over to early America. The large quantities of raw goods that would be needed to drive mass production would require reliable and inexpensive transport. Americans realized that goods could be hauled for longer distances – and more cheaply – by cart, carriage or barge than on a packhorse. They also realized that irregular and unreliable postal service, even between main coastal cities, was hampering the expedient execution of commerce.

As a result, the first advances in the provision of transportation infrastructure in the United States – beyond the gradual improvement of local roads – were the establishment of canals, turnpikes and toll bridges. Canal projects were amongst the earliest projects to be surveyed and to attract the attention of the leading business and political interests of the time. The *Schuylkill and Susquehanna Canal* (later called the Union Canal), which ran between Reading and Middletown in Pennsylvania, was planned and located in 1762. These early projects were largely funded by direct tolls and levies on those utilizing the system – establishing the "user fee" principle that continues in spirit today. If a project could rely on user fees, advocates and officials could avoid the difficult enterprise of convincing disparate groups to invest in projects through taxation or property assessments that provided "lumpy" or targeted benefits. These fees, however, often proved inadequate and many early canal projects foundered under intensive capital costs and logistical difficulties in construction. In a somewhat characteristic example, the aforementioned Union Canal was not constructed to its originally planned length until 1827 – a full sixty-five years after it was surveyed.

[8] *Ibid.* p.23

The early 1800s also saw the development of the first turnpikes. Though planning for the earliest turnpikes commenced well after that of the earliest canals, many were completed far more quickly and became profitable. The development of turnpikes signaled the beginning of a generally new business model in providing for transportation infrastructure. In the past, roads, harbor improvements and aids to navigation were largely financed and constructed and operated directly by the states or local governments. From the construction of the earliest canals it became clear that tax support for such large, complex infrastructure projects was mostly inadequate and the ventures were forced to enlist private capital. From the beginning, most turnpike operations were chartered as private companies that operated under obligations and restrictions set forward by the states. Turnpike companies would then issue stock to raise capital, construct an initial stage of the road and then apply a portion of the collected tolls to expand and lengthen the road. The first such turnpike charter was given by the Pennsylvania legislature to the *Philadelphia and Lancaster Turnpike Company* in 1792. This business model would later be replicated in form by many of the American railroads – often with the encouragement of state governments eager to promote infrastructure development without burdening their budgets.

Internal Improvements & State Authority (1820 to 1850)

The 1820s and 30s generally marked a time of intense competition between rival states and relatively little federal oversight or involvement in transportation. As the Northwest Territory and the new states of Ohio, Indiana and Illinois became more heavily settled, it became apparent that the coastal states best able to facilitate trade between the established seaports and the resource-rich Midwest would reap significant economic benefits. With the federal government generally refusing to take a role in setting policy, the states began to plan infrastructure improvements independently to their own benefit – often at the expense of other regions. The most significant of these so called "internal improvements" was the world-renowned Erie Canal.

Opening in 1825, this 4 foot deep, 40 foot wide channel revolutionized interstate transport and for the first time truly opened up the Midwest for trade and development. Transport costs between the Great Lakes and the Atlantic were cut by more than 90% compared to overland routes.[9] The canal would eventually solidify New York's position as the primary port city in the burgeoning nation.

Congress originally offered to fund the "Great Western Canal" across New York as part of a package of federal improvements known as the *Bonus Bill of 1817*, but the legislation was vetoed by James Madison who, like Jefferson, his predecessor, had some doubts regarding the constitutionality of federal involvement. This led to a furor amongst the congressional leaders that had helped to shape the legislation, including John C. Calhoun and Henry Clay. As a result, the state of New York quickly stepped in and funded much of the canal directly against the credit of the state. The Bonus Bill veto, according to some, signified a marked transition from what had begun as a consolidation of federal authority in the post-revolution years to a new "era of state power."[10]

Though federal funds were appropriated to build the National Road (the nation's first long-distance paved road – from Cumberland, MD to Vandalia, IL) in 1811, and to construct a number of harbor improvements, these efforts were limited and sporadic. By the late 1820's, much of the earlier interest in direct federal involvement was rendered moot by the fact that states and private interests were now becoming more directly involved in the development of important trade routes and transportation corridors. During this period, a new paradigm emerged in which states and private partners became heavily invested in infrastructure development. Private interests received governmental assistance through exclusive charters, land grants and tax incentives, and direct investment while states received a percentage of toll receipts and stimulated economic development. To many observers of the

[9] The New York State Canal Corporation. *The Erie Canal: A Brief History.* Albany, NY.
[10] *See supra note* 6.

transportation industry, this public-private model seemed "a better organizational answer" to the challenges of the time. [11]

After the opening of the Erie Canal, competition sparked other states to answer with schemes of their own – with varying levels of success. The next year, Pennsylvania commenced construction on the *Main Line of Public Works*, a canal and portage railroad system that would open in 1834 and was later sold to the Pennsylvania Railroad. In 1827, the state of Maryland chartered the *Baltimore and Ohio Rail Road Company* (B&O), a partially state-owned venture to construct a railroad from the port of Baltimore to the Ohio River at Wheeling. The same day that construction began on the B&O, ground also broke on the *Chesapeake and Ohio Canal* (C&O), an effort to build a canal along the Potomac River from Washington to the Ohio subsidized by the states of Maryland and Virginia, the federal government and the cities of Washington, Georgetown, and Alexandria. Unlike the earlier turnpikes, in many cases, states and municipalities took a more active role in financing the construction of canals – by becoming subscribers and shareholders of the canal companies or by assuming the financial burden directly.

During the period between 1790 and 1860, commonly considered the span of the "Canal Era," nearly 4,500 miles of canals were constructed. While some, such as the Erie Canal and the Middlesex Canal between Boston and Lowell were profitable for an extended period of time, for many canals, profitability was never realized and great losses were incurred by the states and private interests that backed their construction. The large debts and rampant speculation surrounding canal construction contributed to a number of perturbations in the national economy, including the Panic of 1837. The construction of the Main Line of canals through Pennsylvania brought the state to the verge of bankruptcy during the 1840s because of its crushing debt load. Some canals were burdened by unexpectedly high capital costs, others simply never realized projected traffic while yet others survived

[11] Seely, Bruce. *Building the American Highway System: Engineers as Policy Makers.* Temple University Press, Philadelphia, 1987.

only long enough to be replaced by parallel railroad lines. By 1880, of the more than 4,468 miles of canals that had been built, more than 1,953 miles had been abandoned – representing nearly 44% of total construction.[12]

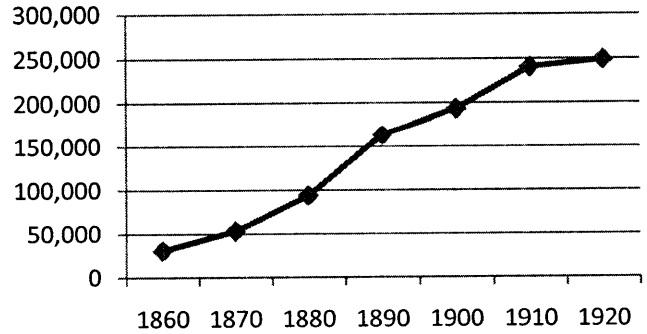
The Railroads & Regulation (1850 to 1890)

By the middle of the nineteenth century, the turnpikes and canals had largely been superseded by the newest transportation technology of the age – the railroad. Though a very small number canals would continue to be profitable – due largely to political rather than economic factors[13] – transport by rail was, on the whole, faster, more reliable and often less expensive than any previous mode. Railroads could be used to climb higher grades than canals and were practical to construct where there was no existing waterway. Perhaps most significantly, the railroads could be used all year round, even in winter months when many canals froze. Beginning with the construction of the first common carrier railroads, such as the *Baltimore and Ohio* in 1830 and the *Mohawk and Hudson* in 1831, railroads quickly established themselves as primary means of transportation in the United States.

The rate of this expansion was remarkable, both for its time and in retrospect. Fueled by a combination of private capital and state cooperation, the number of miles of railroad exploded throughout the balance of the 1800's. By 1840, a paltry series of lines had grown to

Figure 1

Total Railroad Mileage in the United States (By Decade, 1860-1920)



Source: Ringwalt, J.L. ***Development of Transportation Systems in the U. S. 1888***

[12] United States Census Bureau. *Report on the Agencies of Transportation in the United States at Tenth Census 1880.* Washington D.C., 1880.

[13] **Even the Erie Canal required significant protection from the state of New York. Canal advocates insisted upon – and received – restrictions on the state charters of parallel railroads requiring compensation to the Canal for lost traffic and, at least at first, restricting operations to the winter months when the canal was frozen.**

more than 2,755 miles. In 1860, that number had reached 28,919 miles and by 1882, it exceeded 87,800 miles – including two transcontinental railroads that stretched from the Mississippi to the Pacific.

Transportation policy at the beginning of railroad development in the 1830's and early 40's was largely the same as it was during the canal era. States considered new railroad lines as part of their plans for "internal improvements" and played a primary role in chartering and financing their construction. Federal involvement remained minimal. By 1837, states had incurred debts totaling over $40 million in support of railroad development efforts.[14] As railroad planning was almost entirely orchestrated by the states alone, many opted to focus on connecting their own principal cities and developing internal commerce with little thought to interstate cooperation. However, as the debt incurred for new railroads (on top of existing canals) became too great, pushing several states to the brink of financial ruin, many opted to pass so-called "Free Railroad laws" to establish the roads as separate and independent entities.[15] Such began the era of the private common carrier railroad.

While the federal government initially had little part in the development and growth of the nascent railroad industry, local and regional pressure slowly influenced the government to act. In 1838, Congress declared all railways to be post roads and the postmaster general was authorized to pay as much as 25 percent more for transportation of the mail by rail than by coach. This was largely the result of the ambivalence by states' rights advocates about the constitutionality of Federal intervention in public works. As a result, early federal transportation initiatives were often constrained and packaged as postal service initiatives because the Congressional responsibility to provide postal service and post roads is explicitly mentioned in the Constitution. By 1850, with the support of noted politicians, including John C. Calhoun, Stephen Douglas and Jefferson Davis, Congress passed the *Land Grant Act of 1850.* In an effort to encourage railroad growth, the act attempted to help offset the financial burden of railroad construction by granting railroads title to expansive tracts of land made newly accessible by

[14] Mertins, Herman. *National Transportation Policy in Transition.* Lexington Books, Toronto, 1972. p. 7
[15] *Ibid.*

the railroad. It is a noteworthy indication of the pragmatic evolution of US transportation policy that such visible advocates of states' rights would support such a strong new federal role using the rationale of congressional provision of postal routes established in the Constitution.

The terms of this act were continued by the *Pacific Railway Act of 1862,* which added eligibility for federal loans of up to $48,000 per track mile laid. During the period between 1850 and 1871, a total of $64,623,512 was loaned and more than 180 million acres were granted to railroad companies by the federal government.[16] Though there was still some reticence from "strict constructionist" Democrats in Congress, by the late 1860's, driven by a post-Civil War nationalistic fervor and a desire to finally connect the disparate elements of the Union, the federal government's policy of standing on the sidelines of the transportation debate was over.

Ironically perhaps, by the 1880's, the railroads in a certain way became victims of their own success. The economics of railroad construction and operations, through increasing returns to scale[17], tended to promote natural monopolies in the industry. Railroads often used their monopoly power by employing varying rates and services to the advantage of different corporations and customers. Railroads were increasingly seen as corrupt and manipulative as evidence mounted that they frequently colluded amongst each other to their mutual benefit. More generally, politics began to shift from the promotion of economic development to the restraint of overly-powerful private enterprise. Starting in the late 1870's, western legislatures passed a series of bills known collectively as the Granger Laws to regulate grain elevator and railroad freight rates and to address long and short-haul price discrimination by railroads. Though the constitutionality of such laws was challenged, the ability of government to regulate the railroads as public utilities was established by the Granger Cases – most notably the landmark Supreme Court case *Munn v. Illinois* in 1876. Later, in the 1886 *Wabash* case, the Supreme

[16] Chandler, Alfred D. *The Railroads: The Nation's First Big Business.* Harcourt, Brace and World, New York, 1965.
[17] Kim, HY. *Economies of Scale and Scope in Multiproduct Firms: Evidence from US Railroads.* Staff General Research Papers 11698, Iowa State University, Department of Economics, 2004.

Court struck down an Illinois law outlawing long and short-haul discrimination clearly establishing the exclusive power of Congress to regulate interstate commerce.[18]

In the wake of the Granger Cases, the federal government stepped up its efforts to regulate the practices of the railroads by passing the *Interstate Commerce Act* in 1887. The act created the first independent regulatory agency in the federal government – the Interstate Commerce Commission – to administer and enforce a "just and reasonable rate structure" for the railroads.[19] Quickly thereafter, Congress passed the *Sherman Antitrust Act* of 1890, which applied to all industries but was pursued with a particular eye towards controlling railroad consolidations. By 1890, federal transportation policy *was* railroad policy; the thrust of at this time which was to curtail and control the "excesses of private enterprise." It is particularly interesting to note the rapidity with which federal policy changed from the vigorous promotion of new railroads in the mid-1860s to the implementation of unprecedented measures to control system growth and management only twenty years later.

The "Good Roads" Movement (1890 – 1920)

As the nation entered a new century, the American road system was perhaps the least developed of the available modes of transportation. However, in the early twentieth century, an interest in publicly-funded roads and highways was revived, largely stimulated by rapid technological innovation. Larger and heavier horse-drawn coaches – and eventually early trucks and automobiles – required higher quality roads for long-distance travel than private companies (or for the most part, states and local municipalities) were prepared to provide. Additionally, the provision of quality roads became a popular social movement. Instigated first by rural interests, urban bicyclists and public health advocates lobbying for paved streets, the "Good Roads Movement" grew to include academics, engineers, farmers and later, automobile users. Partly in reaction to the movement, in 1893, Congress established the Office of Road Inquiry (a precursor to the Bureau of Public Roads, now the Federal Highway

[18] *See supra note 14,* p. 9
[19] *Ibid.*

Administration) under the Department of Agriculture to provide guidance and engineering advice to states regarding road construction. More significantly, in 1916, Congress approved the *Federal-Aid Road Act* which marked the first time in nearly a century that the federal government took an active role in establishing "interstate highways." The 1916 Act provided for the establishment of a 1¢ federal gas tax and authorized federal funds (matched on a 50/50 basis with the states) for highway construction on rural roads to be used for mail delivery.[20]

This early restriction to "post roads" represented a continuation of a long-standing tendency in transport policy towards strict constructionist interpretations of the U.S. Constitution. Rather than relying on the more expansive Interstate commerce clause, early transportation laws justified federal involvement on the ability of Congress to "[t]o establish post offices and post roads." This relatively restrictive definition of the federal role was mirrored in the railroads (which were all designated post roads) and in the subsidization of early aviation service. This conservative tendency also helps to explain the relatively limited extent of early federal involvement.

During the formulation of this first highway bill in 1916, a significant debate evolved in Congress over the appropriate role for the federal government in administering and constructing the new national road network. The debate revolved largely around whether the responsibility for the development of public works of national interest fell to the federal government or to the states. Many road users and those in the automotive industry called for the creation of a federal highway department and a direct national role. Many engineers and managers in the Bureau of Public Roads itself, however, called for a more federalist solution in which states would fund and construct roads subject to inspection and approval by federal engineers. In the end, a compromise solution was reached in which federal and state officials would cooperatively plan the system, funding responsibility for construction would be shared and then states would own, operate and maintain the completed roads. The act also established the

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[20] Federal Highway Administration. *Highway History*. http://www.fhwa.dot.gov/infrastructure/history.cfm. Accessed July 2009.

precedent for using a formula system for determining levels of federal aid for each state. The first formula was based on three factors: Land Area, Population and the total mileage of Rural Free Delivery (RFD) and "star routes" (two types of post road).[21] Though the implementation of the new programs laid out in the 1916 Act were largely put on hold as the United States entered World War I, the tenets of the legislation continue to form the roots of the federal-aid transportation paradigm in effect today.[22]

Though the 1916 legislation represents a significant landmark in federal involvement in the transportation system, it is also representative of the incrementalism and partiality of federal action in this field of policy. At this time period, transit needs in cities were being reasonably met by the private sector, with some local government support, and the road needs of urban areas were largely satisfied by municipal action and limited state intervention. For rural areas unable to raise sufficient funds for their sizeable needs, however, the federal government represented the "funder of last resort." As a result, the federal-aid system, while rhetorically rooted in the user fee principle of the gasoline tax, represented from its very earliest years, a sizeable transfer of funds from urban drivers (who were still subject to the tax) to eligible rural areas. This pattern defined the system for decades, and in many ways continues to this day.

A Time of Upheaval & Change: The Pre-Interstate Era (1920-1940)

By the end of the first World War, the federal government had begun to get more involved in planning and promoting the development of a national system of highways, but to a great extent, U.S. transportation policy remained focused on railroad regulation. Railroads continued to carry 84 percent of intercity common carrier freight traffic and 85 percent of passenger miles. [23] The nation's top railroads still ranked amongst the largest and most profitable of American enterprises. For this reason,

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[21] Kaszynski, William. *The American Highway: The History and Culture of Roads in the United States.* McFarland, 2000.
[22] *See supra note 11*
[23] *See supra note 14*, p. 13

the effect of road construction on the sustainability of other modes and the source of future federal funding for the roads that were being built or improved was of relatively little concern.

The lack of foresight and cohesiveness in federal transportation policy during this period is perhaps best demonstrated by the close juxtaposition of two pieces of federal legislation. The *Transportation of Act 1920* was intended largely to put railroads on a stronger footing after having been taken over by the federal government during the War. By authorizing consolidations, providing for more flexible labor practices and by instructing the ICC to set rates at a level that ensured a "fair rate of return," the federal government intended to perpetuate a strong railroad network. At nearly the same time, the *Federal Highway Act of 1921* significantly expanded the program of federal road aid, allowing the states – together with the Bureau of Public Roads – to designate up to 7% of their road system (no longer exclusively post roads) to be eligible for federal matching funds. Funding was increased to an average of $75 million per year.[24] No effort, however, was made to form a coherent federal transportation policy and instead Congress would continue to deal with each mode independently.

By the 1930's, the federal role in surface transportation funding had further expanded. The Bureau of Public Roads (BPR) took on a more aggressive role in planning the nation's highway network, working in 1926 with the American Association of State Highway Officials (AASHO) – the transportation advocacy organization founded in 1914 – to designate the system of United States Numbered Highways (more commonly known as the "U.S. Routes"). Additionally, the size and scale of federal-aid road construction grew significantly during the Great Depression under the various work-relief programs established by President Franklin Roosevelt.[25] In 1939, the BPR was shifted to Federal Works Agency (FWA) and renamed the Public Roads Administration (PRA). More funds were expended for federally-funded road construction during the depression than on any other form of public work. In addition, starting in 1938, for the first time, urban corridors became eligible for federal-aid

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[24] *See supra note 21.*

[25] Federal Highway Administration *America's Highways 1776-1976*, Washington, D.C., 1976.

highway funds, further expanding the federal role. This important decision, which recognized for the first time the importance of urban highway infrastructure to interstate commerce, led to increased federal highway expenditures and sowed the seeds for what would eventually become the Interstate Highway program. [26]

Federal road-building during the Great Depression also represented one of the earliest wide-reaching examples of federal infrastructure development justified on the basis of economic stimulus. Though the development of strong transport links has long been understood to promote economic growth, here road construction was used to provide work during an era of high unemployment. Similarities can be seen between this example and the approach of the economic stimulus package implemented in 2009 to address the current recession.

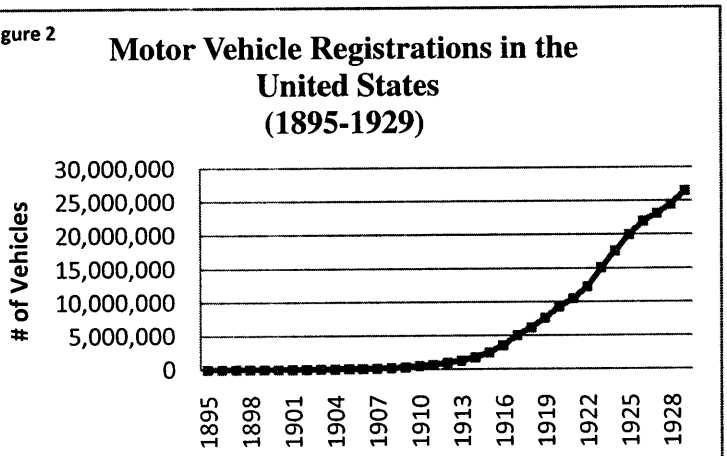
[26] Ibid.

The Development of Today's Transportation Policy

The Fight to Finance the Interstate System (1944-1956)

By the 1940's, more and more pressure was mounting for the United States to construct a network of high quality, high speed interurban and interregional highways. More than any other factor, this need was driven by sheer user demand. Between 1905 and 1929, the number of motor vehicles in the U.S. had exploded from 78,000 to 26.5 million.[28] By 1940, many families already owned multiple cars and the nation had quickly established itself as the most auto-dominant culture in the world. The changes in transportation policy that would result, both at the state and federal levels, therefore, were almost entirely reactive rather than the result of a rational plan of action or established goals.

Figure 2



Source: Facts and Figures of the Automobile Industry. See Note 23.

Throughout the first two decades of the twentieth century, government at nearly every level had failed to keep up with the demand for more and better roads and highways. This trend, however, began to slowly reverse itself. By 1920, states expanded the use of utilize property and sales taxes (and eventually gasoline taxes) to finance road construction. During the decade from 1920 to 1929, in fact, road costs added up to the second largest area of governmental expense.[29] Most of these roads, however, were local in nature. As the federal government began to grow in scope and in power in the 1930's under President Roosevelt, more and more road advocates began to look to the federal government to take a leadership role in establishing – and funding – a modern high-speed road network.

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[28] *Facts and Figures of the Automobile Industry.* National Automobile Chamber of Commerce. New York, 1930.
[29] Rose, Mark H. *Interstate: Express Highway Politics.* Regents Press of Kansas. Lawrence, 1979.

Different groups of advocates utilized different rhetoric, and at times took up divergent positions in the fight for new highways. Farmers and rural legislators looked for better roads to connect farms to markets. Truckers and Interstate bus operators lobbied for better connections between cities and to important ports. Developers and urban planners wanted new expressways to connect city centers with the newly blossoming suburbs and (perhaps ironically) to revitalize blighted neighborhoods. Engineers pushed for increased safety, increased speed and higher quality road surfaces. The military prioritized roads that would connect bases and critical areas of national defense. Nearly everyone heralded road construction as boon for tool for job creation – particularly during a time of desperate economic hardship.

Additionally, transportation advocates and policymakers remained divided as to how this massive undertaking should be funded. Some pushed for a nationwide system of interconnected but independent and self-sufficient toll expressways planned, funded and constructed under the auspices of the states. Others felt that it was in the national interest for the federal government to take a more direct and active role. The *Federal-Aid Highway Act of 1938* directed the BPR to study the feasibility of a continental system of toll expressways, but in their report *Toll Roads and Free Roads,* published the next year, the Bureau demonstrated that a nation-wide toll highway network would not be self-supporting. Instead, the BPR advocated a 26,700-mile federally-funded interregional highway network. Again in 1944, a major report, titled *Interregional Highways*, supported a system of 33,900 miles of rural routes, plus an additional 5,000 miles of auxiliary urban routes. Congress acted on these recommendations by approving the *Federal-Aid Highway Act of 1944* which called for the designation of a National System of Interstate Highways, to include up to 40,000 miles "... so located, as to connect by routes, direct as practical, the principal metropolitan areas, cities, and industrial centers, to serve the national defense,

and to connect at suitable border points, routes of continental importance in the Dominion of Canada and the Republic of Mexico."[30]

The 1944 Act, however, failed to program funds specifically for the new Interstate system. Though AASHO lobbied for more funds ($1 billion/yr) and a greater federal share of construction costs (75%), the intent of Congress was that the existing federal-aid program – which was funded out of the general fund on a 50/50 match basis – would suffice for the implementation of the Interstate program. As a result, Congress authorized $500 million per year for federal-aid roads but left it up to the states to begin construction on the Interstate system using formula funds from existing grant programs. The new Interstate highways, however, were to be built to much higher design standards than existing federally-funded roads and were significantly more expensive than traditional highways to construct. They also often served interstate links, not related to existing highly-used corridors serving intrastate needs.

Fairly quickly, it became apparent that the states lacked the resources for such an expansive undertaking both because of insufficient amount of federal funds and because of an inability to match the federal dollars that they did receive, and because states continued to prioritize funds for existing intrastate travel corridors. By 1949, a number of states were forced to forfeit at least some portion of their federal aid for lack of sufficient matching funds. To a large extent, infighting between different groups of road advocates – truckers, farmers and engineers – prevented significant new action to address these shortcomings throughout the late 1940's and early 1950's.

Truckers, for instance, took steps to maximize state spending on roads using broad-based taxes while simultaneously lobbying to eliminate federal fuel and equipment excise taxes. Farmers pushed for increased spending on rural road programs (at the expense of intercity routes) while the urban lobby pushed for the opposite. Engineers in the state highway departments simply pushed for as much construction as practicable – even using revenue bonds – to expand their profession and to fend off the

[30] Mertz, W. Lee. *Origins and Construction of the Interstate System*. Federal Highway Administration. Washington D.C., 2002.

challenge posed by new toll expressways. As such, while specific funding for the Interstate program was finally authorized in the *Federal-Aid Highway Act of 1952*, it was given only a token amount of $25 million a year. Legislation in 1954 authorized additional sums, but it was becoming readily apparent that general fund revenues would prove insufficient to accomplish the needs of any of the conflicting groups of road-advocates.

It was under the overarching leadership of President Dwight D. Eisenhower – and a number of his executive appointees – that the divisive politics of road construction was finally overcome, a new federal role in surface transportation was cemented and the question of how to fund the Interstate System was resolved. Soon after his inauguration in 1953, Eisenhower began assigning key staffers and cabinet officers to investigate ways to address the impasse and to formulate a plan to fund the Interstate highway network. Eisenhower appointed General Lucius D. Clay, his deputy during the end of World War II and one of his closest advisers, to head the *President's Advisory Committee on a National Highway Program* charged with crafting a plan to construct the new system. Though Clay's plan, published in 1955, eventually succumbed to congressional concerns about excessive borrowing and its effect on the federal budget, it reflected a serious desire on the part of the administration to overcome the inertia holding back the new system. With this added momentum, by February of the next year, Congressmen Hale Boggs and George Fallon and Senator Albert Gore (Sr.) each introduced elements of what would eventually be consolidated into the *Federal-Aid Highway Act of 1956*.[31]

This plan finally addressed previous concerns about financing the system by calling for moderate tax increases that would be obligated exclusively for highway building. The gas tax would be increased from 2¢ to 3¢, but highway user tax revenue from excise taxes on gasoline, tire rubber, tube rubber, and the sales tax on new trucks, buses, and trailers would be credited to a new Highway Trust Fund and reserved for use on the Interstate System and other highway projects. The new Highway Trust Fund

[31] Weingroff, Richard F. *Federal-Aid Highway Act of 1956: Creating the Interstate System*. Public Roads, v. 60, no. 1, 1996.

(HTF) would be established in the model of the Social Security Trust Fund – tax revenue is deposited into the general treasury, but is credited to the Fund. This "user fee" model – continued from the nation's earliest transportation systems – formed the core of the compromise solution that led to the passage of the law (This is the reason Congress must still authorize and appropriate transportation program expenditures on a recurring basis even though most funding is derived from the dedicated HTF). In an effective continuation of earlier federal policy, focusing highway expenditures towards rural development, the "user fee" paradigm also masked a significant financial transfer from the more heavily populated (though more developed) urban areas to more sparsely populated rural areas. In addition, the rural elements of the system were, in most cases, constructed earlier than their urban counterparts.

As a result of this compromise, advocates had devised a system that would pay for the federal share of all federal-aid highway projects, ensuring a self-financing system without burdening the general fund. The new law mandated a "pay-as-you-go" process in which the system was constructed as funds became available, without the use of financing tools such as bonding. It also established the federal share of project costs on the Interstate system at 90 percent, mandated updated nationwide standards, authorized an accelerated construction program and established a new method for apportioning funds among the States (states would receive Interstate construction funds based upon their share of work remaining according to a regularly-updated federal *Interstate Cost Estimate*). The bill largely succeeded because it linked the collection of needed revenues to roadway users, seemed to give substantial victories to each of the opposing constituencies, provided substantial new funding to all 50 states, and largely isolated highway financing from the federal budget. With approval from the administration and numerous industry groups for most of the elements of the new plan, the 1956 Act quickly gained traction and was approved in June of that year by both houses with little opposition.

Practically no consideration was given to the operations and maintenance needs of a system that, for the most part, did not yet exist. The assumption was made that the Interstate system would operate

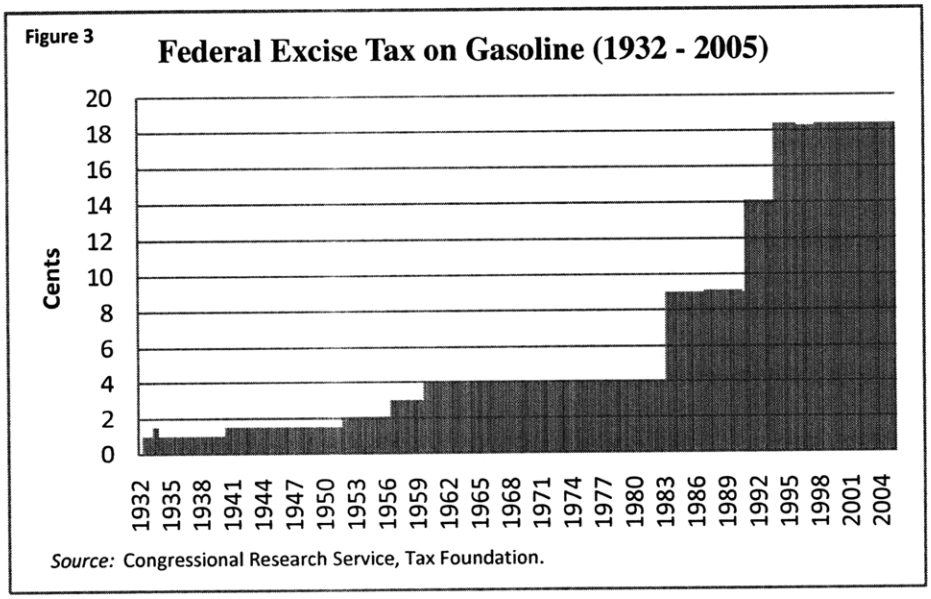
just as the federal-aid system had in the past – with the states assuming the duty for upkeep of all federally-funded roads. This assumption was largely unchallenged.

Evolution, Not Revolution: Changes to the System Since 1956

Although there have been more than twenty pieces of legislation reauthorizing the federal surface transportation program since 1956, changes in federal role in transportation funding and policy have been relatively limited in scale and scope. Planning and construction of the Interstate system advanced quickly after the passage of the 1956 Act. As early as June 1957, the BPR had already approved of 80 percent of the corridors that would encompass the original 40,000-mile system. As costs for labor and material to construct the now-planned corridors continued to increase, Congress was forced to increase the gas tax to 4 cents on a "temporary" basis in the *Federal-Aid Highway Act of 1959*. A long series of Highway Acts and continuing resolutions reauthorized the federal surface transportation programs throughout the 1960's, maintaining the 4¢ tax and largely leaving policy and administration unchanged.

Federal responsibility for funding highway projects was transferred to the newly-created *Department of Transportation* in 1967, in an effort to integrate the transportation planning process.

Figure 3



The establishment of the US DOT also represented a new reality that the health of the transport system in urban areas was no longer healthy enough to be sustained without federal intervention. The co-location of urban transit programs (from HUD) with highway administration (from Commerce) was

an attempt to bridge the divide between these two transportation solutions, but initially changed little regarding the structure or funding of the programs themselves.

The next significant evolution to the federal policy came in the early 1970's under President Nixon. Following the urban 'highway revolts' of the late 1960's and early 1970's – most notably in Boston and San Francisco – the *Federal Aid Highway Act of 1973* for the first time allocated funding for mass transit projects – a sum of $1 billion from the general fund. The law also introduced the "interstate transfer," permitting states – with federal approval – to abandon uncompleted Interstate highway projects and receive an equivalent sum of money from the general fund. For the first time states could choose to substitute subway, bus and commuter rail projects for highways without forfeiting federal funds. This change in federal policy helped to prompt a resurgence in urban mass transit investment during the 1970's, most notably by facilitating construction of the Washington D.C. Metro[34] and major extensions to subway lines in Boston[35], Baltimore[36] and Chicago[37]. Further recognizing the emerging multimodal emphasis of transportation, the Nixon administration also introduced Federal operating subsidies for public transportation, providing 50% of subsidy requirements of small systems, with significant total funding (albeit at smaller percentages) in large systems as well.

The *Surface Transportation Assistance Act of 1982*, championed by President Reagan and Secretary of Transportation Drew Lewis, notably increased the gas tax from 4¢ to 9¢, and for the first time established a separate account in the Highway Trust Fund for transit projects. Secretary Lewis skillfully packaged the 5¢ increase as a continuation of the user fee principle rather than a new tax increase and was able to successfully make this argument to President Reagan and his congressional allies. After this increase, the Highway account received 8¢ of the revenue from the gas tax while the new Mass Transit

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[34] Thompson, R. Wayne. *Metro at 25: Celebrating the Past, Building the Future*. WMATA. Washington D.C., 2001.
[35] *Assessment of Community Planning for Mass Transit: Volume 3—Boston Case Study*. United States Congress, Office of Technology Assessment. Washington, D.C., February 1976.
[36] *Baltimore Metro: Two, and Growing*, Railway Age Magazine, November 1985.
[37] Barnes, Eugene M. *Report of the Public Transportation Subcommittee*. Interstate Transfer Implementation Committee, Public Transportation Subcommittee. Chicago, 1979.

account received 1¢.[38] The gas tax was increased again in 1990 and 1993 (by 5¢ and then 4.3¢) and partially diverted to the general fund under the auspices of deficit reduction, but these increases were eventually fully applied to the Trust Fund. President George H. W. Bush was significantly less successful at framing the 1990 fuel tax increase as a user fee than President Reagan had been eight years earlier and suffered perceptible political consequences as a result. The federal gas tax has stood unchanged at 18.4 cents per gallon since 1994.

A landmark was reached in 1992, when the Interstate Highway system – as originally conceived – was deemed to be essentially complete with the construction of I-70 through Glenwood Canyon in Colorado. New political actors also began to reframe the transportation debate around the issues of metropolitan mobility, livability, accessibility and sustainability rather than simply new construction and capacity expansion.[39] With this in mind, federal legislators crafted the *Intermodal Surface Transportation Efficiency Act of 1991* (ISTEA) as the first federal surface transportation reauthorization of the post-Interstate age. ISTEA for the first time posited transportation planning in an intermodal framework and took deliberate steps to empower Metropolitan Planning Organizations (MPO's). Though MPO's had been federally recognized since the 1954 highway act and had been made part of the formal process for planning urban Interstate routes since 1962, they were largely considered junior partners of state highway departments and lacked independent power. After a decade or more of being consigned to a minimal role in transportation planning, ISTEA gave MPOs increased funding, expanded authority to select projects and the imperative to plan in accordance with environmental regulations and requirements. State transportation officials were required to consult more thoroughly with local representatives on MPO governing boards.[40]

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[38] Weingroff, Richard. *Palace Coup: President Ronald Reagan and the Surface Transportation Assistance Act of 1982*. FHWA. Washington, D.C..

[39] Camph, Donald H. *Transportation, The ISTEA, and American Cities*. Surface Transportation Policy Project, Washington, D.C. April, 1996.

[40] Solof, Mark. *History of Metropolitan Planning Organizations*. North Jersey Transportation Planning Authority. Newark, NJ, 1998.

In addition, ISTEA realigned the federal-aid highway system for the first time in decades. The Act combined four separate Federal-aid highway categories (Interstate, Primary, Secondary and Urban), each with their own program, into the new unified **National Highway System**, keeping only the Interstate System as a distinct subset. For the first time, ISTEA introduced programmatic changes to explicitly account for the profound need to finance system maintenance in addition to, or instead of construction. The existing Interstate 4R ("rehabilitate, restore, resurface and reconstruct") program was refocused and renamed the **Interstate Maintenance** (IM) program. IM dropped the "reconstruction" element of 4R and served to finance projects to maintain the Interstate System *without expanding capacity*. ISETEA also implemented a new **Congestion Mitigation and Air Quality Improvement Program** with which states and MPO's can fund projects that will have a demonstrable impact at helping non-compliant regions meet ambient air quality standards.[41]

ISTEA also acknowledged the emerging need to manage the operation of highway systems by recognizing the potential for new technology to support this need. Initially called IVHS (Innovative Vehicles Highway Systems), and later ITS (Innovative Transportation Systems), these systems today represent the state-of-the-art in modern highway operations practice. ISTEA was intended by congressional leaders to be a transformative piece of legislation. "It marks the transition from system building to system performance" said Sen. Daniel Patrick Moynihan, one of the chief architects of the legislation. However, though it represented an evolution of the policies developed throughout the latter half of the twentieth century and introduced a change in program structure, the legislation maintained most of the existing allocation formulas and largely fell short in achieving its goal of ushering in a paradigm shift in funding priorities or the meaningful integration of performance metrics into the

[41] *Intermodal Surface Transportation Efficiency Act of 1991 – Summary*. US Department of Transportation, Washington D.C., 1991.

federal-aid process.[42] In many ways, this result was due not to an incorrect conceptualization of the problems affecting the system, but rather to a lack of dedicated funding for many of the most progressive changes in the legislation.

Few significant changes have been implemented in federal policy or in the structure of the federal program since ISTEA. The *Transportation Equity Act for the 21st Century* (TEA-21) passed in 1998, largely reauthorized existing ISTEA programs. This legislation also made it easier for states to transfer federal dollars between programs and accounts and increased available funding for operations technologies such as Intelligent Transportation Systems. TEA-21 also expanded the **Minimum Guarantee** concept, ensuring that no state received less than 90.5% of their contributions to the Highway Trust Fund back in federal aid.[44] Though previous legislation had included minimum guarantee firewalls at the program-level, TEA-21 integrated this concept into a new core program and expanded its reach to include almost the entirety of the federal program.[45] This program is representative of a continuing trend by legislators to attempt to spread the benefits of federal investment across as broad a spectrum of the nation as possible. While this does assist in the process of building a political constituency in support of transportation funding, this practice purposefully serves to diffuse the benefits of investment, meaning that areas of the system with the greatest needs often receive inadequate support while other areas receive funds in relative excess. The new legislation also established revised budget rules to more closely tie programs authorizations to actual Highway Trust Fund (HTF) Highway Account receipts, linking appropriations to incoming revenue.

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[42] **Much of the fault for ISTEA's lack to achieve transformative change in the system is attributed to the fact that many of the key initiatives, including efforts to ensure comprehensive preventative maintenance plans, were largely underfunded.**

[44] *The Transportation Equity Act for the 21st Century – A Summary*. US Department of Transportation, Washington D.C., 1998.

[45] *Issue Position: Transportation*. Remarks by Congressman Lincoln Diaz-Balart. October 1998.

TEA-21 was followed by the *Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users* (SAFETEA-LU) in 2005. SAFETEA-LU, the legislation currently in force, also introduced only incremental changes to the program. The act established a new core Highway Safety Improvement Program and introduced a number of new financing mechanisms to accelerate infrastructure construction including grant anticipation and private activity bonds, as well as additional flexibility to use tolling to finance infrastructure improvements. Most markedly, perhaps, SAFETEA-LU built upon the Minimum Guarantee concept by implementing the new **Equity Bonus** program that promised states a 92% return on their contributions to the Trust Fund. Today the Equity Bonus allocation represents the single largest item in federal appropriations for the surface transportation program. This continues the gradual trend away from appropriating funds based upon systematic needs to a paradigm in which funding distribution is the result of a political struggle between states that receive more or less than their perceived "fair share" of highway dollars – often ignoring current needs or the effects of other uncorrected historical imbalances.[46]

The most pressing debate over the future of the federal surface transportation program today is how to how to address the shortfall in revenues while addressing ever-growing system needs. More than any time since the 1950's, the finances of the federal program lie in doubt. With the federal fuel excise tax unchanged since 1994, returns to the Highway Trust Fund have been susceptible to erosion by three factors: inflation, increased fleet fuel economy, and – for the first time since 1980 – an overall decline in annual vehicle-miles travelled[47]. As a result, the HTF collected $31 billion in revenue between October 2007 and September 2008 — $3 billion less than it collected in Fiscal Year 2007, while federal transportation spending increased by $2 billion. For the first time, in September 2008, the Highway account of the Trust Fund essentially ran out of money, requiring the infusion of $8 billion from the general fund to sustain programs for the balance of the fiscal year. Multibillion dollar shortfalls are

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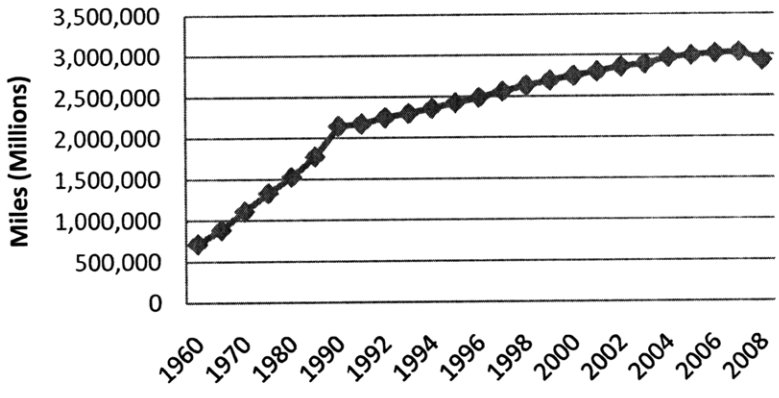
[46] **Such as the outflow of funds from urbanized states (often now donee states) in the early days of the system.**

[47] *Traffic Volume Trends*. http://www.fhwa.dot.gov/ohim/tvtw/tvtpage.cfm Federal Highway Administration. Accessed July, 2009.

again predicted for Fiscal Years 2009 and 2010, requiring stopgap action by Congress to continue spending at authorized levels.[48] With the future of the Trust Fund is currently in doubt, long term financing of the federal program will likely be one of the most important matters of discussion as the surface transportation program comes up for reauthorization in 2009-2010.

Figure 4

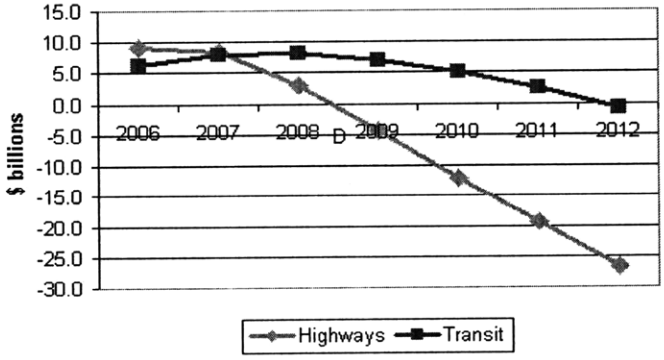
Annual Auto Vehicle Miles Traveled in the United States (1960 - 2008)



Source: Bureau of Transportation Statistics. **Note discontinuity in scale between 1990/92**

Figure 5

Projections of Highway and Transit Account Balances Through 2012



This exhibit shows projected balances in the Highway and Transit Accounts of the Highway Trust Fund through 2012 assuming no change in revenues or program levels.

Source: National Surface Transportation and Revenue Study Commission & U.S. Treasury.

[48] Crawley, John and Lambert, Lisa. *Government Estimates $20 billion Highway Funding Shortfall.* Reuters. June 25, 2009.

The Importance of Changes in the Federal Role

An overview of the history of transportation policy in the United States demonstrates quite clearly that there has been constant, ever evolving controversy surrounding the proper role and responsibilities of all of the relevant actors – federal, state, local and private – in the provision of a robust and reliable transportation system. Though transportation policy has gone through steady transformation from its colonial roots to the present day, on the whole, the result of this battle has been an ever-increasing federal role in the process of infrastructure development. Though this evolution is often taken for granted, is important to recognize the concomitant benefits and costs of this important shift. Though states and local municipalities contribute much more money in infrastructure spending annually than the federal government, it is the federal government's unique position to leverage competition over federal-aid dollars that has allowed it to assume primacy over charting the direction of future transportation policy. Along with expansion of the Federal role, there has been an increasingly multi-modal approach, and increasing recognition of the needs of urbanized as well as rural areas.

Increased federal involvement has decreased competition between states and facilitated the process of regional and metropolitan planning. In the earliest years after the Revolution, the states and local municipalities largely stood alone in providing early aids to navigation and port improvements. Though some of the nation's earliest leaders, such as Treasury Secretary Albert Gallatin, realized that truly national problems – like providing for sustained economic growth – required national solutions, a strong federal role in infrastructure development was originally eschewed. With Madison's veto of the Bonus Bill in 1817, the federal government had largely abandoned this role, leaving the states as the driving force in the development and execution of (often disparate) transportation policy. In cooperation with private actors, the states provided for the rapid growth of wide-reaching networks of canals and inland waterways, turnpikes and eventually railroads. However, far too often these efforts were built to the advantage of particular cities or states, and were not considered part of an overarching national effort. The Erie Canal, for example, was built out of an effort to benefit New York, not the Union – the

understandable result of Madison's veto and the lack of federal leadership. Starting with railroad regulation in the 1880's and the support of rural highways and connectors beginning in 1916, the federal role has slowly, but steadily increased. In the years since, federal intervention has facilitated the construction of a more comprehensive system that touches nearly every American household – chiefly the roads of the National Highway System, the Interstates, and the growing mass transit systems. This change, however, has not come without some costs.

While the process for funding, constructing and operating transportation infrastructure has become more and more dominated by the federal government, it also has continued to be somewhat reactionary and partial. Political and social pressure influenced the federal government to step in to simultaneously curtail the excesses of the railroads and to promote "good roads" – often without consideration of the long term effects of these changes. As auto use in the United States exploded during the first half of the twentieth century, policymakers, engineers, businessmen and advocates saw an opportunity to fulfill a whole host of (often contradictory) desires through a massive road improvement plan. Each group wanted new roads, but each wanted avoid the burden of paying for it. Some advocates pushed for the states to assume the burden, others thought that the federal government should build and operate all of the roads directly.

The Interstate system as we know it was largely a product of political pressure from long-haul truckers who lobbied against local tolls, urban and business advocates who saw highway investment as key to growth and state highway officials that understood that a road construction program of the size and scale that they envisioned could only be accomplished with federal aid and a national focus. Though the compromise that was eventually wrought did construct the Interstates, it made little provision for the operation of the system and the growing cost of maintenance and reconstruction upon the states. Due in significant measure to the focus on building more and more roads as quickly as possible, for decades, federal transportation policy placed little emphasis on comprehensive maintenance and operations of a road network that was clearly established in the national interest. It

also initially ignored the poor conditions of urban transit systems, and the need to improve transit in order to provide alternatives to the growing congestion in urban areas.

The reality of the situation is that today's problems are actually a result of the success of the last generation of policy architects. The significant accomplishment of constructing the entirety of the original system, however, was paired with a long-standing disregard for the real upkeep needs of the constituent infrastructure elements. Additionally, as the majority of the Interstate system was rolled out during the 1960's, 70's and 80's and states received their share, they began to lose their most important incentive for supporting the federal program – net new dollars for the new expressways. As a result, with the completion of the system in the early 1990's, it has been more difficult than ever to build a consensus around a particular vision for transportation policy, and in many ways the minimum guarantee and earmark initiatives have served to consolidate support to continue the program in the lack of a compelling vision with distinct benefits. .

This phenomenon has made it increasingly difficult for both states and the federal government to procure the necessary resources to both sustain the system that is currently operating and to construct the targeted expansions necessary for continued growth. For this reason, this next reauthorization cycle represents a unique moment in which existing revenue streams are proving inadequate and there is a clear and demonstrable need for increased federal involvement in funding the system. The ongoing need for economic stimulus in the midst of the worst economic downturn since the 1930's adds to the urgency. It is in just such a situation that unique solutions for the future and meaningful reform are most likely to emerge. The following chapters attempt to provide additional material to inform such a development.

Chapter 2: A Description of the Current Policy Paradigm

Introduction

As the previous section demonstrated, the scale and scope of the federal role in surface transportation development has changed significantly over the nation's history. However, over the past half-century, the federal transportation program has evolved into a relatively consistent status quo. Though it began as a relatively targeted effort focused on building interstate highways, the federal program has now grown to $57 billion a year enterprise funneling appropriations into 108 separate programs, initiatives, projects and studies under current legislation. Knowledge of the structure, characteristics and history of the constituent elements of the existing federal surface transportation program is an important part of understanding the current policy paradigm, its effect on the existing system and on the ability of federal and state governments to provide for future needs. This section will provide a brief overview of the federal surface transportation program, with a focus on the Federal-Aid highway appropriations disbursed by the Federal Highway Administration (FHWA).

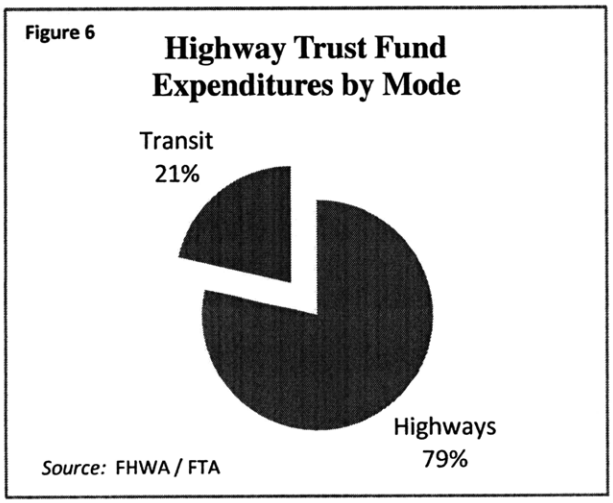
System Architecture: The Federal Surface Transportation Program in Brief

As a discretionary program, like many other federal initiatives, the surface transportation program is governed through a two step process. First, the program is reviewed under the auspices of cyclical authorization packages which set new policy, delineate funding levels for constituent programs and establish contract authority for the various recipients of grants-in-aid (largely state departments of transportation). These pieces of reauthorization legislation are debated and crafted every five or six years by the relevant topical standing committees of Congress – primarily the Committee on Transportation and Infrastructure in the House and the Committee on the Environment and Public Works in the Senate. The authorization legislation provides an opportunity to make alterations to the system architecture, eliminating some programs and introducing others, and serves as a framework for the second step in the process – annual appropriations by the budgeting committees. Nearly all of the

funding appropriated for the elements of program is derived from the federal excise fees on fuel and other auto supplies collected into the Highway Trust Fund.

The authorizing legislation currently in effect is the *Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users* (SAFETEA-LU), signed August 10, 2005, which authorized $286.4 billion for expenditure and extended the program until September 30, 2009.[49] SAFETEA-LU authorized 108 distinct programs under eleven "titles," including Federal-Aid Highways, Highway Safety, Public Transportation, Motor Carrier Safety, Research, Transportation Planning and Project Delivery, and Rail Transportation, amongst others. The vast majority of these programs are administered by the constituent modal agencies of the U.S. Department of Transportation, including the Federal Highway Administration (FHWA), the Federal Transit Administration (FTA), the Federal Railroad Administration (FRA), the Research and Innovative Technology Administration (RITA), Federal Motor Carrier Safety Administration (FMCSA) and the National Highway Traffic Safety Administration (NHTSA).

Figure 6



Out of the $244.1 billion guaranteed funding for highways, highway safety, and public transportation under SAFETEA-LU, $193.2 billion was allocated to Federal-aid highway programs[50] and $52.6 billion for federal transit programs[51]. Though the transit initiatives play an important role in improving metropolitan mobility and reducing our nation's reliance on foreign petroleum imports by sustaining public transportation providers, today, as it has been for the

[49] *SAFETEA-LU Implementation*. http://www.fta.dot.gov/index_4696.html. Federal Transit Administration. Accessed June 2009.
[50] Ibid.
[51] *Transit Funding Information*. http://www.fta.dot.gov/index_6536.html. Federal Transit Administration. Accessed June 2009.

last half-century, the bulk of the federal transportation program is focused on the nation's system of roads. As a result, this work will focus primarily on the elements of the largest federal transportation initiative – the Federal-aid Highways Program.

Federal-aid Highways Program

The Federal-aid Highways program is one of the broadest and widest-reaching grant-in-aid initiatives overseen by the federal government. Far from being limited to Interstate highways, the program is responsible for providing matching funds for construction and rehabilitation of more than 987,613 miles of major state and interregional routes, including the Interstates, U.S. Routes, many state highways and even some local connectors, arterials and county routes. Though the program was previously divided into different systems – Interstate, Primary, Secondary and Urban – distinctions in terms of funding these different categories of roads have largely been eliminated in the wake of the 1991 ISTEA legislation.

As currently authorized, the Federal-aid Highways Program includes 63 discrete constituent programs, with an even greater number of setasides, takedowns and pilot initiatives (sub programs that receive a percentage or fixed amount of the funding appropriated to their 'parent program') specifically delineated in legislation. Each program is governed by its own guidelines and restrictions on how funds can be utilized and serves to accomplish a distinct congressionally-mandated purpose. Though funds disbursed some earlier programs (e.g. Interstate Construction) were allocated on a cost-to-construct basis using a detailed needs analysis, most programs today are subject to distribution by established formula. The funding formulas are based on characteristic factors such as total lane miles of Federal-aid highways or Interstate highways, total vehicle miles traveled, population, annual contributions to the Highway Account of the Highway Trust Fund or metrics of local and regional roadway use. Some smaller programs are more carefully targeted in their disbursement. Each program serves to fund a particular road classification, project type or construction activity. The federal share of project funding depends largely on the type of project and the classification of road; Interstate projects generally receive

90% while non-Interstate projects receive 80%. In certain states with large amounts of federal lands, the share can be up to 95%. Certain safety and emergency relief projects are eligible for 100% federal contributions.

While many of the constituent programs are relatively minor, with low funding levels or limited scope, fourteen of these initiatives, known as the "core programs," are considered the backbone of the Federal-aid road program. Of the $41.98 billion appropriated under the Federal-aid Highways Program in 2009, these programs $40.43 billion are disbursed by these programs. [52] The largest among these (which receive more than a billion dollars a year) are described in brief below[53,54]:

National Highway System (NHS): *Authorized at $6.31 billion for 2009.*

First established under the 1991 ISTEA legislation, this program combined long-existent independent programs for Primary, Secondary and Urban highway systems in an effort to give states additional flexibility in programming their funds. In addition, the Interstate Highway system is included under the broad umbrella of the NHS, though it maintains its own independent program as well. As a result then, the program can be utilized on essentially any road of federal interest including the "Interstate system, other rural principal arterials, urban freeways and connecting urban principal arterials, facilities on the Defense Department's designated Strategic Highway Network, and roads connecting the NHS to intermodal facilities."[55] For additional flexibility, states can also transfer up to half of their NHS apportionment to their Interstate Maintenance, Surface Transportation (STP), Congestion Mitigation and Air Quality Improvement (CMAQ), Highway Bridge or Recreational Trails program accounts.

Surface Transportation Program (STP): *Authorized at $6.58 billion for 2009.*

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[52] *Highway Authorizations: Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (P.L. 109-59).* Federal Highway Administration. Washington D.C., April, 2006.

[53] *Fact Sheets for Highway Provisions in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU).* Federal Highway Administration. Office of Legislation and Strategic Planning. October 25, 2007

[54] *See Supra note 3.*

[55] *See Supra note 4.*

Another program established under ISTEA, the STP is considered the most broadly applicable initiative in the federal-aid program. STP funds can be used to support projects on any Federal-aid highway, bridge projects on any public road, intra-city and inter-city bus terminals and facilities and other enhancements. Additionally, STP funds can be transferred to FTA accounts to fund transit capital projects under flexible funding arraignments introduced in TEA-21.

Interstate Maintenance (IM): *Authorized at $5.2 billion for 2009.*

Also established under ISTEA, the Interstate Maintenance program serves as a successor to the Interstate 4R program, established in the 1978 Surface Transportation Assistance Act and expanded in 1981 to rebuild and add capacity to the original Interstate system. This program is intended to assist states in "rehabilitating, restoring, resurfacing, and reconstructing" (also known as "4R" projects) the Interstate Highway System. Though funds had traditionally been limited to capital expenditures like roadway reconstruction, FHWA guidance beginning in the 1990's and continuing through 2004 (currently in effect) has permitted the use of IM funds for preventative maintenance.

Projects funded through this program are limited to the Interstate System and are generally restricted to maintenance projects that do not increase capacity. Current law forbids the use of these funds for the construction of additional lane-miles for general use, however, funds can be used for HOV and auxiliary lane construction. IM program funds are allocated by a formula similar to the NHS and STP programs but specific to the Interstate system. Like NHS funds, IM is eligible for flexible funding and states can transfer up to half of their apportionment to other accounts including STP, CMAQ, and trail and bridge programs.

Highway Bridge Program: *Authorized at $4.46 billion for 2009.*

Bridge program funds provide states with targeted funds to improve the condition of their bridges through replacement, rehabilitation, and systematic preventive maintenance. Unlike most other accounts, bridge program funds are allocated by state according to their relative share of the total cost to

repair or replace deficient highway bridges. In addition, at least 15% of program funds must be spent on non federal-aid program bridges – giving states an incentive to invest in local roads and feeder routes.

Congestion Mitigation and Air Quality Improvement Program (CMAQ): *Authorized at $1.78 billion for 2009.*

The CMAQ program was intended to support transportation projects that assist in meeting and maintaining national ambient air quality standards for ozone, carbon monoxide, and particulate matter in out of compliance regions. Funds are apportioned according to a formula based on population and severity of pollution. In a rare instance, this program attempts to integrate performance metrics into the administration of program funds; an evaluation and assessment of all CMAQ projects and programs is required to determine their direct and indirect impact on air quality and congestion, however, these determinations are often cursory at best.

Highway Safety Improvement Program (HSIP): *Authorized at $1.3 billion for 2009.*

This program, newly introduced as a core program under SAFETEA-LU, was previously funded as a mandatory setaside under the STP account. The program is designed to "devote additional resources and support innovative approaches to reducing highway fatalities and injuries on all public roads." Funds can be expended on any public road or publicly owned bicycle and pedestrian pathway or trail, subject to setasides for high risk rural roads.

High Priority Projects Program: *Authorized at $2.97 billion for 2009.*

Unlike the previous programs that are, for the most part, formula-based and allocated to the states for expenditure on projects at their discretion (within the constraints of the program requirements), the High Priority Projects Program is a collection of congressionally-directed setasides. Generally, funds for particular project are specifically designated and are available only for that project.

Equity Bonus: *Authorized at $9.09 billion for 2009.*

The Equity Bonus program is actually the largest single line item in the federal surface transportation program, but to call it an independent program is somewhat misleading. Equity bonus is the newest manifestation of a policy that has been in place under different names for several authorization cycles in an attempt to guarantee states a fixed minimum return on statewide contributions to the Highway Trust Fund and a minimum increase (121% in 2009) relative to the average dollar amount of apportionments under previous legislation (TEA-21). The sum total of funds allocated to a state through the core programs and the equity bonus itself must equal (in 2009) at least 92% of the state's contributions. As such, Equity Bonus serves as a buffer for states that would receive proportionally less money through the core programs as a result of the structure of the formulas that govern their distribution. States that receive proportionally higher amounts of funding through the core programs receive no Equity Bonus funds. The significant majority of Equity Bonus funds are simply programmatically redistributed to the state's receipts under the IM, NHS, Bridge, STP, HSIP, and CMAQ programs – assuming the same restraints and eligibilities as funds already disbursed under those accounts.

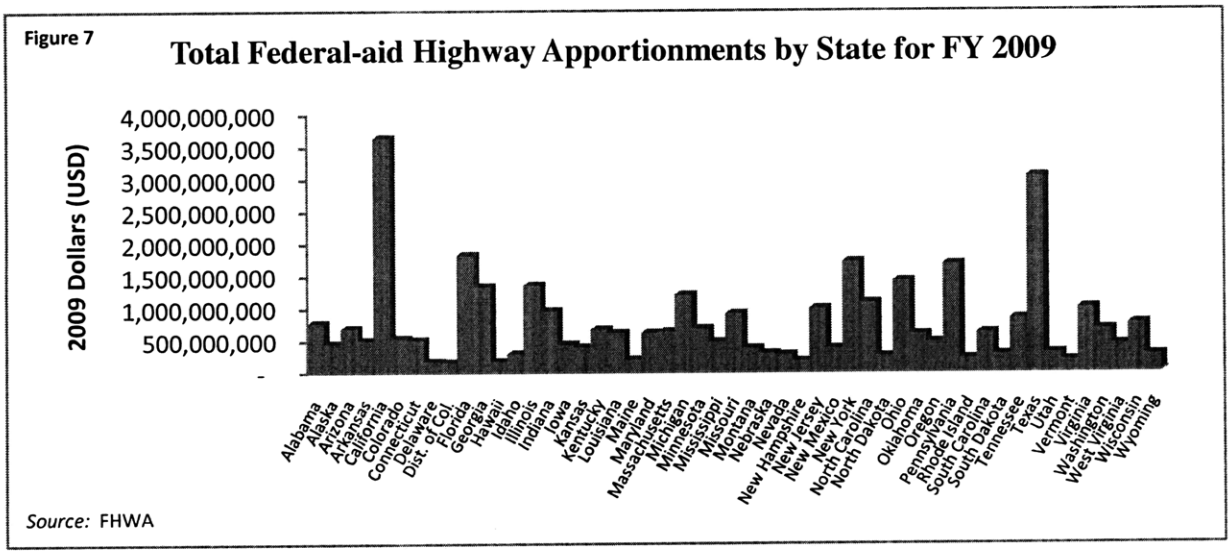
The other core programs that comprise the federal-aid highway program include Metropolitan Planning, the Appalachian Development Highway System, Recreational Trails, Safe Routes to School, Rail-Highway Grade Crossing and the Coordinated Border Infrastructure programs. These initiatives, however, receive relatively small amounts of funding and are targeted at addressing specific needs rather than systematic maintenance or construction. The federal program also includes significant funds for transportation improvements, roads on federal lands ("direct-fed"), broad-based research, and development of Intelligent Transportation System (ITS) technologies. Though these initiatives are also important components of the federal program and are likewise derived from Highway Trust Fund revenues, these programs represent only a very small percentage of the funds used by states for the

upkeep or reconstruction of their federal-aid roads and an exhaustive description of these programs would be excessive.

Distribution of Federal Aid by State

Due to the differing needs of the various states of the union, the congressionally-mandated objectives of the different constituent elements of the federal-aid highway program and the various formulas that guide their allocation, by design, different states receive different fractional shares of federal outlays. Some states with unique geographical and demographic circumstances receive significantly higher returns on their contributions to the Highway Trust Fund. Five states – Alaska, Montana, Rhode Island, North Dakota and Vermont – as well as the District of Columbia, received in excess of 200% of their HTF contributions as part of the federal-aid program in FY 2009. Conversely, a large group of states have traditionally received less from the federal program than they had contributed in taxes. Thirty states, from Maine to Florida and from Virginia to Washington, fall into this category.

Figure 7



Source: FHWA

This issue of federal-aid "equity" has grown to become one of the most hotly politicized topics regarding the federal program. Significant tension has grown between advocates of the so-called "donor" states that receive less than their HTF contributions and "donee" states that have positive returns. In the past, much of the allocation of funds from the federal program was based on a systematic analysis of need. The Interstate Construction program – the core program established in 1956 to fund

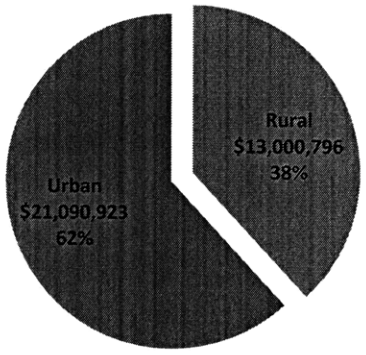
the Interstate System – allocated funds to the states based on their fraction of work remaining as defined by a regularly-updated comprehensive cost study of the entire Interstate system (the Interstate Cost Estimate). Since ISTEA in 1991, the federal program has included a minimum guarantee, or "equity bonus" to attempt to decrease the disparity between states by ensuring that no state receives less than 92% of their HTF contributions in the total of all federal-aid receipts. Unsurprisingly this places additional limitations on Congress and the USDOT's ability to put HTF revenues where they are most needed or will effect the greatest return on investment and further exacerbates the challenge of addressing urban congestion.

Distribution of Federal Aid by Infrastructure Class

The evolution of the federal-aid system, even from its earliest roots in the 1920's, has resulted from a tension between political actors advocating for a federal focus on different types of infrastructure investment. Farmers and legislators from Midwestern and southern states looked to federal support for rural and farm-to-market roads. Truckers and other long-haul shippers pushed for a comprehensive of rural intercity highways to connect geographic regions. Urban advocates didn't care much about either rural collectors or highways; they envisioned a way to solve the toils and blights of the city through the construction of inner-city expressways to open up new areas of development while strengthening the urban core. The federal-aid program that exists today is largely a result of constant compromises between these different constituencies. The Interstate highway program, by providing clear incremental funding to all 50 states, helped to unify the disparate constituencies behind the national program, but as the Interstate system became complete, that motive to cooperate has been lessened.

Figure 8

Obligation of Federal Funds by Rural/Urban Designation for FY 2007



Source: Highway Statistics, FHWA

The times, have changed, and with that, the program has begun to evolve. The distinctions between the different needs of the federal program are starting to blend as the character of the nation becomes more uniform. For the first time, in 2005, more than 80% of Americans lived in urbanized (urban/suburban) areas.[56] Whereas the needs of rural users largely continue to be met by the system constructed in the latter part of the last century, continued growth in metropolitan areas has spurred new development, putting ever mounting pressure on the urban system – often leading to chronic congestion. Long-haul truckers and commuters who waste hours of time and money stuck in congestion have lobbied for increased capacity at key bottlenecks and better operations and maintenance of regional highways, particularly in metropolitan areas. Additionally, though urban planners and advocates now recognize that new inner-city highway construction is usually a less beneficial development tool than public transit, urban engineers still push to preserve the capacity that exists and to improve user safety while dealing with the very complex task of rebuilding aging sections of heavily-traveled roads. As a result, the federal-aid program has taken on a more and more urban focus, particularly over the last two decades, with urban projects receiving roughly $8 billion more than rural projects in FY 2007 – representing 62% of federal spending.[57]

Overall Spending

Though the federal program receives the most attention regarding efforts to fund the nation's important highways and thoroughfares, it is important to remember that the federal program is but one element of overall road spending in the nation each year. In addition to the state match required of nearly every federally-funded project, states spend billions of dollars annually on many construction, repair and maintenance projects adopted independently, without federal support. In addition, counties and local municipalities are generally responsible for the upkeep and maintenance of local streets, connectors and some arterials. State and local maintenance spending on highways alone significantly

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[56] *World Urbanization Prospects: The 2007 Revision.* Department of Economic and Social Affairs. Secretariat of the United Nations. New York, 2007.

[57] *Highway Statistics 2007.* Sheet FA-10. Federal Highway Administration. Washington D.C., 2008.

outweighs the entire federal-aid highway program. In FY 2004, the last year that comprehensive data is available, the total amount of funds allocated by FHWA under the Federal-aid Highways program was $29.78 billion[58]. The total outlay on roads by all levels of government – including capital costs, operations, maintenance, administration, safety and finance charges – was $143.6 billion.[59]

Though a cursory glance at these figures might lead the reader to conclude that the federal role in funding the system is, in relative terms, quite limited, it is important to remember that a significant amount of state (and even local) funding is in fact driven by the incentive of federal funds. In many cases, it would be significantly more difficult to build political constituencies around necessary transportation investment at the state level without the incentive that the availability of federal funds provides. In short, the leadership role of the Federal government in transportation is far more significant than its proportionate share of funding would suggest.

[58] *Highway Statistics 2004.* Sheet FA-3. Federal Highway Administration. Washington D.C., 2004.
[59] *Highway Statistics 2004.* Sheet HF-2. Federal Highway Administration. Washington D.C., 2004.

Chapter 3: A Life-cycle Approach to Evaluating Funding Levels

Introduction

More pressing than any other issue regarding the future of federal surface transportation program is the matter of financing the program itself. The debate today – as it often has – pivots on the issue of funding – from revenue sources and amounts, to allocation parity amongst the states to the overall scale of the program itself. Funding levels over the past 15 years have largely been a product of projected revenues from the unindexed (for inflation) and largely unchanged federal excise fees (particularly the gas tax). This proved sufficient as long as the average automobile did not become more fuel efficient (thanks in part to the popularity of SUV's) and the total number of vehicle-mile travelled continued to increase. However, as these factors have begun to change, current tax levels are proving inadequate for the needs of the existing program forcing Congress to reevaluate the needs of the system and to address the difficult task of finding adequate new sources of revenue.

At this point in the evolution of the surface transportation program, things have changed to such a significant degree that the policy assumptions of decades past cannot be presumed to still hold. Rather than the pressures of system expansion and construction, the most critical needs of the system are driven by efforts to maintain the current infrastructure. The huge network of existent roads and transit infrastructure drive system costs and should likewise drive policy. The most pressing concerns to be addressed are addressing the state of repair and congestion. These issues, however, will require a different approach, different information, and a different policy architecture than was needed to tackle past problems.

In a time where the overarching goal of the surface transportation is in flux, and the maintenance and reconstruction of existing infrastructure is of chief importance, it is important to develop a reasonably impartial mechanism for evaluating the appropriateness and adequacy of funding levels for

the federal transportation program. At the very least, most actors involved in the debate over transportation funding have begun to agree that it is in the clear national interest to maintain the system that we already have developed. In order to build on this consensus and to inform the debate, this chapter will present a method of cost estimation proposed for the federal-aid highway system – using the Interstate Highway program as an example – that is driven primarily by the cyclical maintenance and reconstruction needs of the system rather than future economic considerations or the characteristics of particular projects. In addition, this chapter will demonstrate how this approach can be used to illustrate a rough way to view the trends in system costs over time and how those costs are borne on the system's stakeholders, namely the federal government and the states.

Though this model serves only as a rough estimate of the needs of the system, it will serve to add to the growing body of research on the needs of the federal system and will help to illustrate how those needs ebb and flow over time – requiring an appropriate policy response.

The Debate over Needs vs. Current Expenditures

In September 2008, for the first time in decades, the Highway account of the Highway Trust Fund was unable to provide adequate funds to cover the programs duly authorized and appropriated by Congress (the Transit account is projected to remain solvent for the next few years, before it too is projected to run out). As a result, the program has relied upon late-hour congressional bailouts twice in as many years in order to honor levels of contract authority promised to the states.[60] In addition, research continues to indicate an ever widening gap between federal and state outlays in surface transportation and purported needs, leading to an ever-growing backlog of deferred investments to the system.

As part of SAFETEA-LU, Congress established two independent commissions, the National Surface Transportation Policy and Revenue Study Commission (Policy Commission), and the National

[60] *See supra note* 48

Surface Transportation Infrastructure Financing Commission (Finance Commission), to among other things, conduct a comprehensive study of the future of the Highway Trust Fund and the "the current condition and future needs of the surface transportation system." In its 2008 report, the Policy Commission produced some stark figures, estimating that current costs to maintain our nation's highway system at $112 billion, compared to $65 billion currently spent by all levels of government. In addition, the commission posited that if all cost-effective improvements were made to the system, that annual number would increase to between $195 billion to $268 billion annually (all in 2008 dollars).

The Finance Commission, in a separate report issued in February 2009, produced similar findings and went into greater depth regarding the shortfall in federal funds. The study estimated in their "Need to Maintain Scenario," that $131 billion is required per year for this nation's highways, including $59 from the federal government and $72 billion from states and municipalities. With $39.8 billion in federal highway funds authorized for this year, that represents a shortfall of **$19.2 billion** in federal outlays each year (in 2008 dollars). This significant gap represents only maintenance needs and does not include any projections of costs to improve the system. Numerous studies and reports issued over the past few years, including those from the Government Accountability Office (GAO), the National Conference of State Legislatures, AASHTO, and the U.S. Chamber of Commerce further reinforce these findings.

The current situation is, however, the result of a long running (and not altogether surprising) set of circumstances, including the steady diminution – in real dollar terms – of revenue to the Highway Trust Fund and an equally steady rise in demands from the states for grant-in-aid funds, particularly for maintenance and reconstruction needs on the primary system (NHS). However, the government finds itself in this conundrum largely as a result of a lack of information about the requirements of our transportation system and through a lack of political will to make investments fueled in part by that lack of information. Though it is easy to investigate the revenue side of the transportation investment equation by studying the historical values of federal and state fuel taxes and revenues deposited each

year into the Highway Trust Fund, the dynamics of the "costs side" of our nation's transportation infrastructure are a bit more obscure. Better understanding the ebbs and flows of the investment requirements to maintain important pieces and systems of infrastructure should help to inform policymakers as they attempt to reform the current system and plan new infrastructure systems in the future.

Current Methods of Needs Estimation

A number of studies are conducted on a regular basis in order to report updated estimates regarding the spending needs of the surface transportation. With the onset of the next reauthorization cycle looming, the frequency and depth of these studies has been on the rise, with government agencies, interest groups and policy advocates weighing in. Though different figures may be cited in different places, depending on the source, most of the work in this area is derived from the National Cooperative Highway Research Program (NCHRP)-funded work published in the annual AASHTO *Bottom Line* reports.

The estimates published in *Bottom Line* utilize a number of different models, including USDOT's HERS (Highway Economic Requirements System), NBIAS (National Bridge Investment Analysis System) and TERM models and represent a far more comprehensive approach at estimating and projecting infrastructure needs than can be found here. The approach is also more data driven, receiving detailed information about future projects from FHWA and the state DOT's. These estimates generally represent the "gold standard" when it comes to projecting the needs of the surface transportation system. That said, there are a number of issues that are missing from the *Bottom Line* models – or the resulting analysis – that could be useful in informing the policy debate and that will be addressed here.

Bottom Line uses a series of methods to inform their estimates, but the bulk of their process is project based, not based on existing system stock. AASHTO's process involves analyzing large databases of individual projects for cost effectiveness under different economic and growth scenarios.

The resulting needs estimate for each growth scenario, therefore, represents the sum of projects that have been estimated to be amongst the most cost effective methods for achieving the capacity needed for that particular scenario. The approach is extremely data intensive and requires accurate estimates of the both the costs and benefits for each relevant project from all levels of government (including municipalities) and on all levels of highway classification. In many cases this analysis is done even in the absence of any meaningful cost-benefit analysis of the project by the state.

Additionally, in *Bottom Line*, AASHTO generally presents a static picture of systematic needs for today and a projection of those needs over a short number of years – typically the next reauthorization cycle. While this outlook might be useful in helping to set the program funding levels of the next transportation legislation, it is not particularly useful in orchestrating long term policy changes or fundamental system-wide reform. This requires a more dynamic – if lower resolution – approach, a more general understanding of how costs in the system are growing and shrinking, and why. It also requires an understanding of how those costs are borne by the different stakeholders involved – in this case, both the federal government and the states. Beyond that, the *Bottom Line* reports fail to explicitly include information regarding the investment needs as a result of Interstate reconstruction, a major policy issue in future reauthorizations.

Using Life Cycle Costs to Estimate Systematic Needs

Overview

In an effort to supplement the policy debate by overcoming some of the shortfalls of existing cost estimates, like *Bottom Line*, a different approach can be utilized. Instead of relying on the estimated cost and benefit characteristics of proposed projects, a model can be formulated by using the known life-cycle costs of a segment of infrastructure, the extent of the constructed system and metrics of inflation and construction costs. As such, it is possible to investigate, at least in rough terms, systematic costs over time based on a relatively small number of inputs in order to demonstrate the changes in

infrastructure investment needs. By focusing on existing infrastructure, this method makes more explicit consideration of maintenance needs and the importance effects of cyclical reconstruction. In addition, the process can be used to estimate the long term effects of prolonged, systematic deferred maintenance – a practice that has in many ways become standard practice.

The method used to produce yearly estimates of infrastructure investment needs over time is in part based on an earlier effort by Ann Friedlaender to project the costs and benefits of then-nascent Interstate System in her 1965 MIT doctoral dissertation[61]. Her method, however, differs from the analysis in this work in two important ways. First, Friedlaender did not account for the variation in costs between various maintenance activities over the lifetime of a piece of infrastructure, instead relying on an average figure per road-mile in calculations. Since the dissertation work did not involve estimating costs or benefits beyond 1981, the work did not include reconstruction costs – assuming all pavement structures would last without major overhaul until 1991. In addition, the earlier work did not take into consideration inflation or indexing factors explicitly, instead relying on a fixed discount factor to calculate a total present value for all systemwide costs over all years in base year dollars. While this may have been useful in studying the cost effectiveness of the system in its early years, this method does not allow for a retrospective analysis of system costs over time in nominal values.

As a result of accounting for these changes, the calculations used in this analysis take the following form:

$$B_j = \sum_i x_i * c_{ij} \left(\frac{CPI_j}{CPI_{base}} \right)$$

Where B_j is the annual cost to (re)construct, maintain and operate, x_i is the extent of infrastructure constructed in year i (with regards to the Interstate System, this is in road-miles), c_{ij} is a cost matrix

[61] Friedlaender, Ann. *The Interstate Highway System: A Study in Public Investment*. North-Holland Publishing. Amsterdam, Netherlands. Chapter 3.

produced using estimated life-cycle costs of a piece of infrastructure (for the Interstate System, this includes incident response, repatching and drain cleaning, resealing, resurfacing and [re]construction costs on a basis determined by maintenance frequency). CPI represents the Consumer Price Index (CPI-U), though this can be replaced by any index of inflation or production costs in order to represent the change in relative purchasing power of the dollar.

For the balance of this chapter, this basic model will be illustrated and utilized to estimate the dynamics and absolute amount of infrastructure investment in the Interstate Highway System providing an insight into current and future needs.

Construction and Maintenance Costs

At the core of this method of cost estimation is a cost matrix comprised of lifecycle costs for an element of infrastructure – normalized by a measure of inflation or a production cost index. These cost values represent the average lifespan of the infrastructure before reconstruction and the average duration between particular maintenance activities. These values will define both large and small scale perturbations in overall estimated investment needs as the bulk of an infrastructure system approaches different maintenance milestones.

For the values of construction and maintenance costs for the Interstate Highway system, two sources were used. For construction/reconstruction costs, data was taken from the April 2002 *Highway Construction Cost Comparison Survey*[62] conducted by the Washington State Department of Transportation (WSDOT). Maintenance costs were derived from a white paper produced by the Sacramento regional MPO (Sacramento Area Council of Governments - SACOG) titled *Road Maintenance* in preparation for their 2035 transportation plan.[63]

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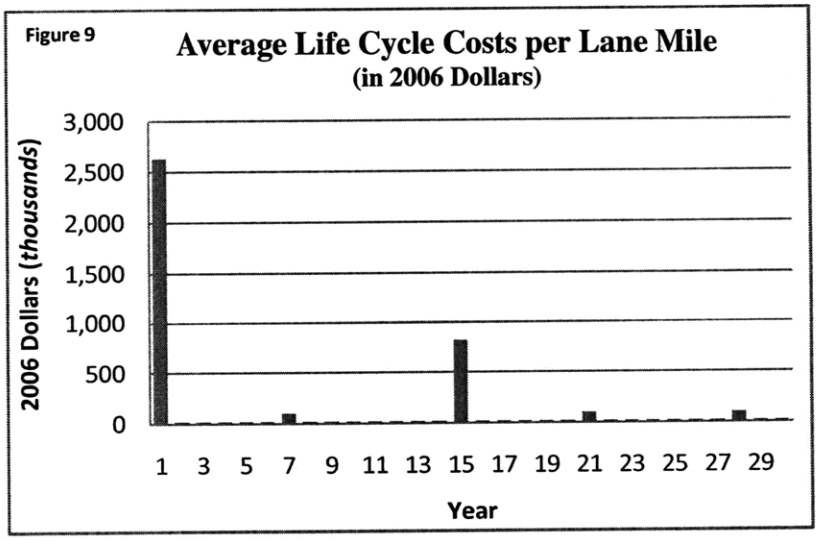
[62] *Highway Construction Cost Comparison Survey*. Washington Department of Transportation. April 2002.
[63] *Road Maintenance: Issue Brief*. MTP2035 Transportation Plan. Sacramento Area Council of Governments. October 2006.

Whereas previous cost comparison studies relied primarily on the differences in commodity costs between difference states, the WSDOT study attempted to capture the complete cost to deliver by providing state DOT's across the nation with the specifications to a representative freeway project from Washington state and collecting their in-house cost estimate. Over fifty WSDOT projects were considered as potential candidates for the survey in an effort to find a representative project that could apply to all the surveyed states. The project selected included the construction of a new alignment of a four-lane expressway facility, the erection of retaining walls and other structures, surfacing, the application of full-depth asphalt concrete pavement (ACP), guardrail and concrete barrier construction, and striping. The results were presented in whole and broken down to demonstrate the cost to construct per lane-mile.

The survey received 25 responses, including WSDOT. The cost to construct a single lane mile of the facility ranged from $1.0 million (Mississippi) to $8.5 million (New York) with an average cost of **$2.3 million**.

Figure 9



The SACOG road maintenance issue paper gathered information on road maintenance and road rehabilitation costs from the 6 counties and 22 cities under its jurisdiction as well as the California Department of Transportation (Caltrans). The report provides estimates for different lifecycle maintenance costs under normal maintenance conditions and under an altered "deferred maintenance" schedule per lane-mile of highway. According to SACOG, annual routine preventive maintenance, including crack sealing, pavement patching, drain clearing costs an average of **$20,000** per lane-mile. Regular heavy

maintenance, including slurry or chip seal coat, adds costs in the range of **$50,000-$80,000** per lane-mile on a seven year cycle. The mid-life pavement rehabilitation – usually a complete asphalt resurfacing – costs an estimated **$300,000-$400,000** and occurs on average at 15 years for a well maintained highway and at ten years for a poorly maintained one. Full roadway reconstruction, which entails removing the pavement and repairing the gravel base underneath, should be undertaken every 30 years for well-maintained roads and at 20 years for poorly-maintained roads.

Figure 10

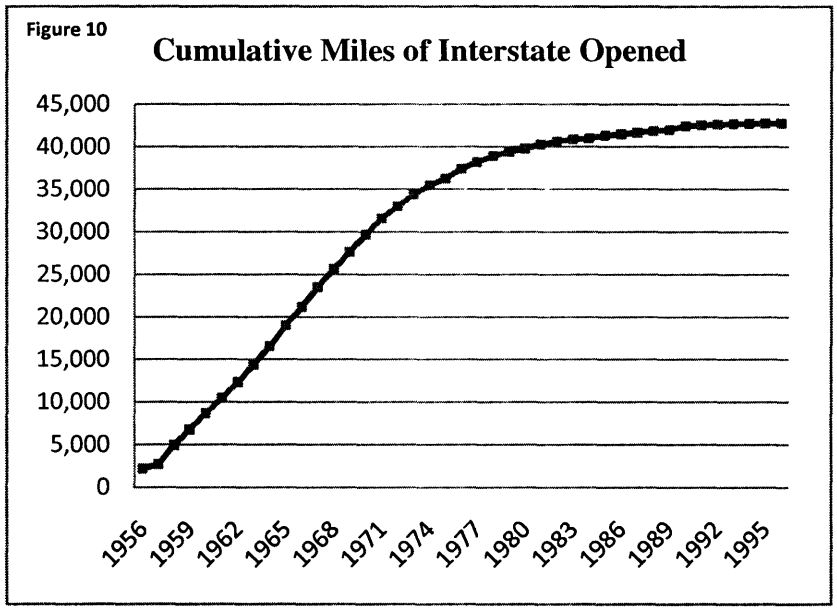
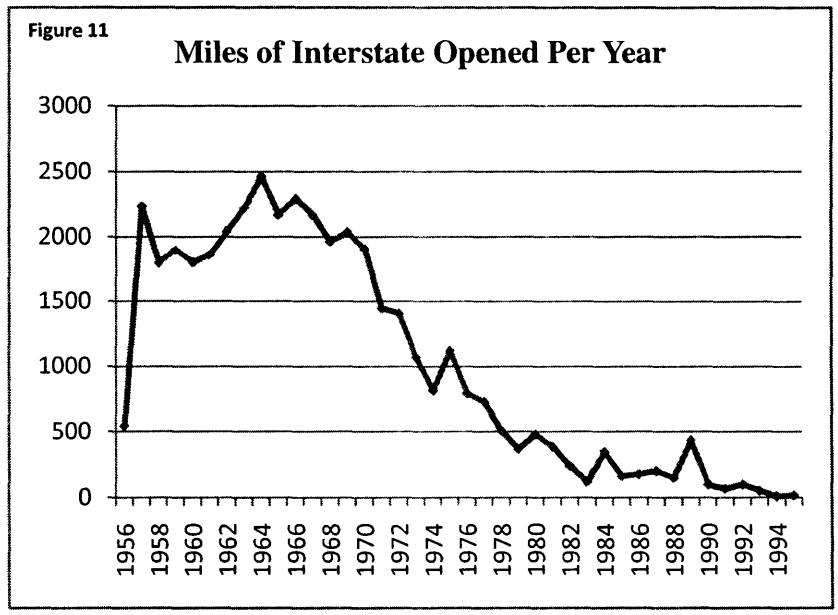


Figure 11



System Extent

Equally important to understanding the cyclical effects of infrastructure construction – particularly for a large and complex project like the Interstate Highway network – is an accurate understanding of the initial rollout of system elements. For the IHS, we have a series of data from the FHWA and USDOT on the annual progress of construction on the system between 1956 and 1995, when 99.9% of "chargeable" (federal-aid eligible) miles were completed. Information on the extent of the system was collected from a series of reports including *Highway Progress*, published by the Bureau of Public

Roads (1956 -1967), the *Annual Report of the U.S. Department of Transportation* (1967-1991) and *Highway Statistics*, published by the Federal Highway Administration (1992-2007). The annual figures for the constructed miles and extent of the system for the purpose of this work include only the chargeable portions of the Interstate system (which comprise 42,764 miles out of the congressionally-designated 46,876 mile network). The other 4,112 miles on the network are signed as "Interstate Highways" but are not eligible for federal-aid through the Interstate program either because they are toll roads or because they were specifically designated by legislation as non-chargeable expansions to the system.[64]

Though the Interstate System was designated by Congress as early as 1944, little had been constructed prior to 1956. The pre-1956 highway mileage that was initially incorporated into the current system was predominantly non-chargeable toll roads and is not included for consideration here. As indicated in the graph at right, following the passage of the *Federal-aid Highway Act of 1956*, progress on the system grew rapidly, with an average of 2,000 road-miles of highway constructed and opened for traffic annually between 1957 and 1970. This sustained period of expansion laid the backbone of the modern system and the cyclical reconstruction needs of this generation of roadways represents the bulk of system costs. After 1970, construction of new Interstate segments declined steadily as the original 41,000 mile system began to reach completion. By 1975, annual construction had dropped to near 1,000 miles and by the 1980's, only a few hundred miles of roadway opened per year. The system was popularly recognized to be complete with the opening of I-70 through Glenwood Canyon in Colorado in 1992; however planning and construction has continued with Interstate-program eligibility on certain limited segments of the network, including Boston's Central Artery Tunnel Project (I-90/I-93) and the Pennsylvania Turnpike/Interstate 95 Interchange Project northeast of Philadelphia.

Though it would be more accurate to use a measure of lane-miles constructed for the metric of system extent/growth, no nationwide data exists for the Interstate Highway System in terms of lane-

[64] *Fact Sheets on Highway Provisions*. Federal Highway Administration. Washington, D.C., 2005.

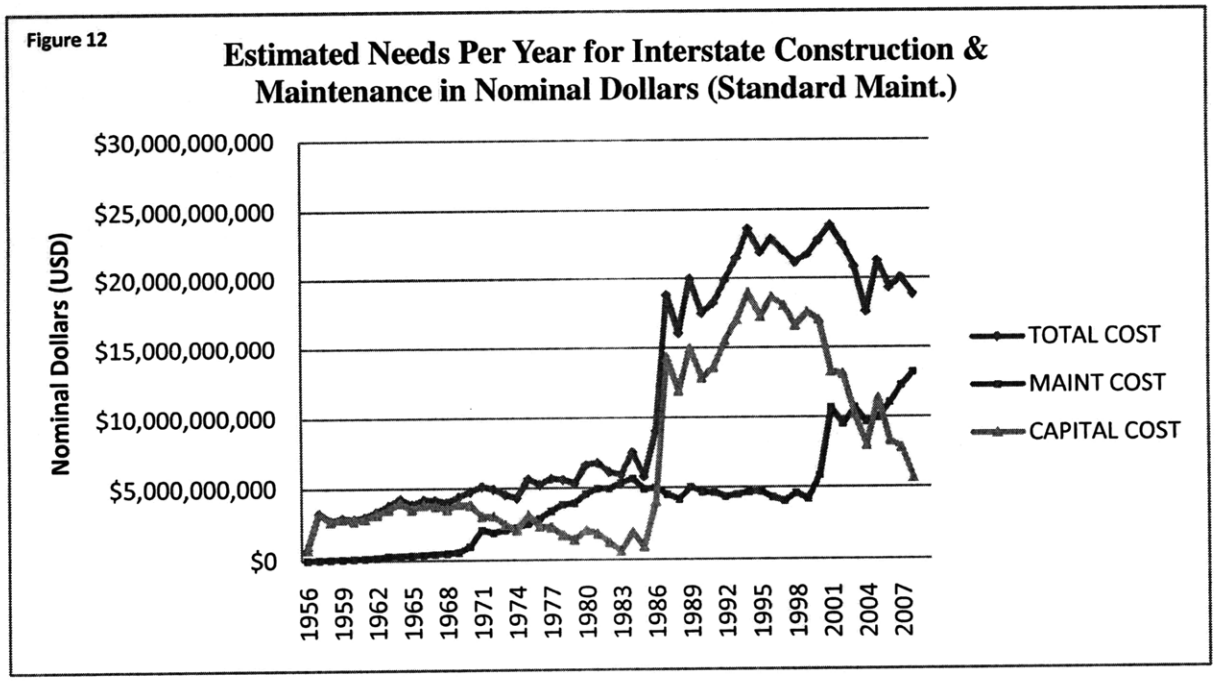
miles prior to 1980. As a result, road miles must be converted into lane-miles for the cost estimate calculations. To be exceedingly conservative, therefore, the entire Interstate System is modeled as a 4-lane divided highway – the minimum standard design specification and the layout of more than 91% of the system.

System Cost Estimates & Trends

The result of cost estimate calculations for the Interstate system from 1956 to the present day (under normal maintenance procedures) paints an interesting picture that illustrates the cyclical nature of infrastructure investment. It demonstrates the rising importance of maintenance costs at the current stage of the investment cycle and provides insight regarding the approximate costs to keep the system operating at designed levels of capacity.

The model produces an estimate of **$18.82 billion** for the total operations, maintenance and capital needs for the interstate highway system in 2008. This compares with the current federal appropriations of approximately **$10.43 billion** in federal outlays – $5.2 billion per annum for the Interstate

Figure 12



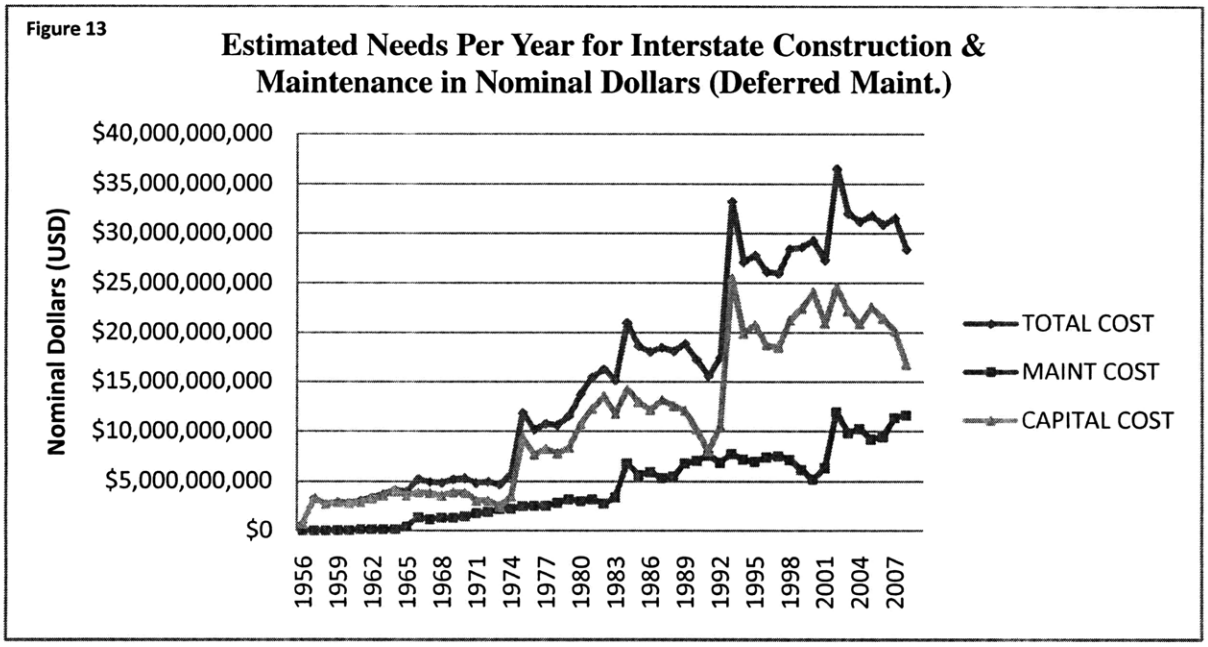
Maintenance program, $2.96 billion for the congressionally-designated High Priority Projects, many of which are on the Interstate system, and approximately $2.27 billion yearly from the ¼ share of the Equity Bonus program that is reallocated specifically for Interstate Maintenance. Though funds from other accounts, like the Surface Transportation Program and the National Highway System can be reshuffled to pay for Interstate maintenance costs, this is done to the detriment of other elements of the highway system, many of which suffer from their own deficiencies. Assuming a 90%/10% federal state match, standard for Interstate programs, this amount equates to $11.59 billion in combined federal and state spending, or a **$7.23 billion dollar shortfall**. This balance represents a burden either to be *assumed directly by the states* or manifested in deferred maintenance and the delay in necessary reconstruction of antiquated elements of the system – often leading to diminished capacity and noticeable decreases in pavement quality and other measures of system performance.

Due to the size and scope of the Interstate system, and the protracted manner in which the system was constructed (over the period of more than 35 years), there has proved to be a continual need for capital funding either to ensure construction of the original system or to perform reconstruction on antiquated elements of the network. That cost (indicated in green in Figure 12) drives a significant amount of system costs. However, at certain periods in the infrastructure cycle for the system – including the next 10 years – maintenance costs eclipse capital costs. This has the potential to put disproportionate pressure on the states, which have historically borne the bulk of maintenance costs, even on the federal-aid system.

Effects of Deferred Maintenance

Calculations were also performed to estimate annual costs of the Interstate system as the result of a program-wide scenario of deferred maintenance. Under widespread deferred maintenance, infrastructure has a shorter lifespan, driving up regular capital costs. This results in significantly increased annual system costs – $28.3 billion vs. $18.82 under normal maintenance – even as maintenance costs decrease 12% from $13.2 to $11.6 billion. Due to the shorter lifespan of roadways

Figure 13



subject to systematic deferred maintenance, the cost curves for both capital and maintenance needs under this scenario are more steadily positive than under normal circumstances. As a result, under deferred maintenance, not only are costs greater in general, but there is also less of an opportunity to "catch up" on delayed capital investments, leading to further delays and further increased costs.

The cost trends indicated in this model may also help to explain why deferred maintenance became such a common phenomenon on the Interstate System – it was being driven by policy. Prior to the mid 1990's, federal guidelines largely restricted federal-aid grants to capital projects as a part of the compromise forged in 1956 to fully fund construction of the system. Maintenance costs were to be fully borne by the states. However, by deferring maintenance – either intentionally or not – states would save on maintenance costs and would be able to spend more federal dollars on capital outlays, bringing more outside money into the state. In this way, federal funding policy established a self-defeating disincentive to responsible governance of the system through an attempt at cost containment.

Distribution of Costs

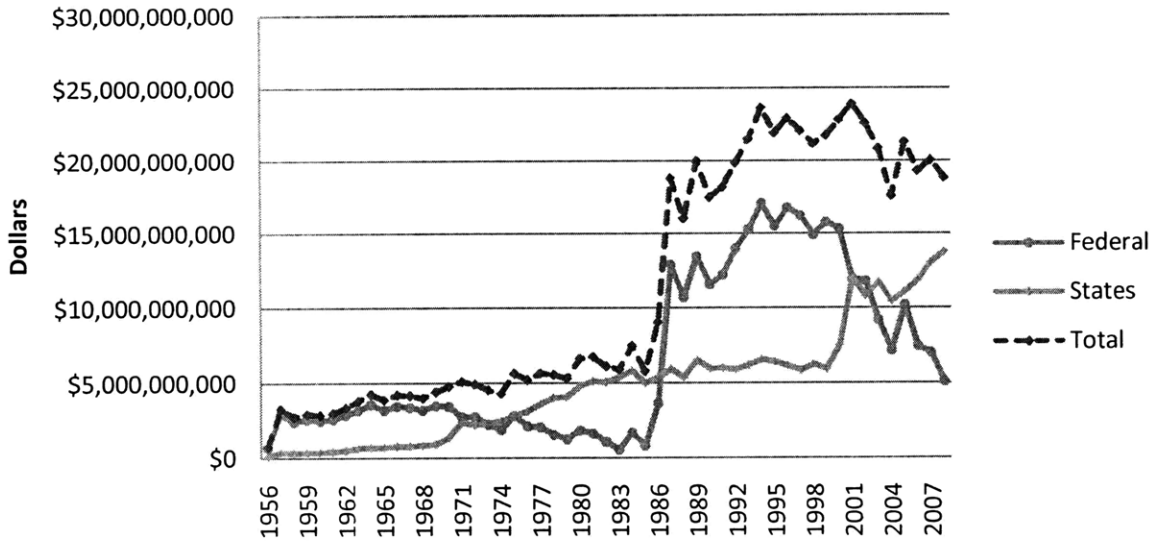
A retrospective look at system costs also provides an opportunity to see how actual federal outlays over the life of the Interstate system compare to the estimated needs of the system. The chart below

(Figure 14) represents the distribution of estimated system needs by stakeholder under long standing federal policy. Prior to the mid 1990's, the federal government bore 90% of capital construction costs while the states were responsible for 10% of capital (on average) and all maintenance costs. Figure 15 illustrates actual federal outlays for Interstate-related programs. These figures demonstrate that while federal funding largely kept pace from 1956 through 1980 (as the system was first constructed), federal spending has since failed to keep pace with the rapidly escalating needs of the system as the first pieces of the system began to require full reconstruction beginning in the mid-1980's.

Additionally, these figures demonstrate the growing burden of operations and maintenance spending – a responsibility traditionally assumed by the states. Though policies for the Interstate Maintenance program have now changed and – beginning in 2004 – preventative maintenance costs on the Interstate system have been federal-aid eligible, states continue to suffer the effects of the overall funding gap. Though overall federal-aid program funds targeted at the Interstates have increased to more than $10 billion per year, this continues to be inadequate at stemming the tide of increased maintenance and reconstruction costs.

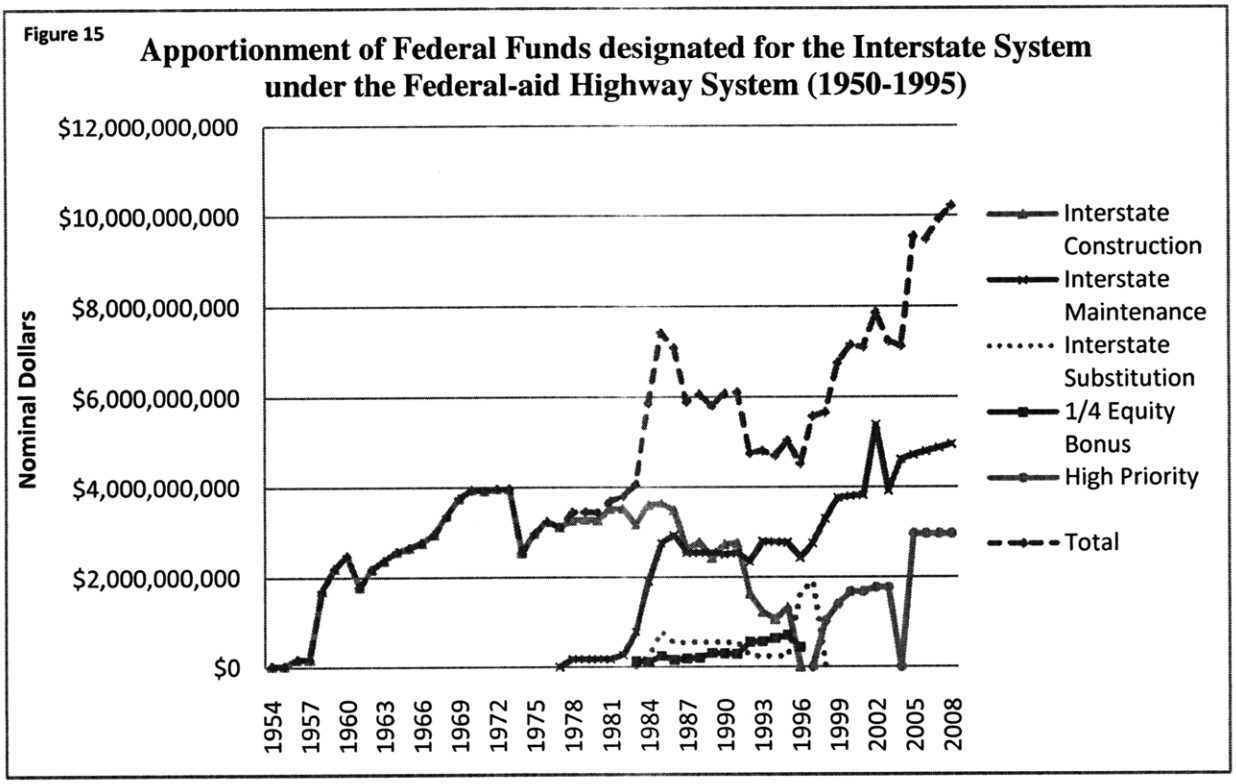
Figure 14

Distribution of Estimated Needs for the Interstate System between the States and Federal Government



Note that this distribution assumes the continuation of long-standing federal policy of investing only in capital projects. In reality, this policy has been gradually relaxed since the mid-1990s.

Figure 15



Conclusion

The above work represents a fairly basic method of illustrating the importance of taking long term costs into consideration when crafting policy that will guide the funding and operation of complex infrastructure systems. Though the method lacks precision due to its use of average figures for common maintenance costs and generalized values for the extent of the system, it represents a more dynamic view at the drivers of costs than other estimates of highway needs. A better understanding of the long term implications of key policy decisions – such as the long-time choice to limit federal dollars to capital spending – in an environment when infrastructure is constantly in need of reconstruction will help leaders to make better decisions in the future. The model also expresses that, over the long term, proper system maintenance clearly saves money over the alternative (on the order of $10 billion per year in 2008) – another important realization for policymakers.

This method, because of its ease of implementation, is also more broadly applicable than other methods. While studies like the AASHTO work that informs the *Bottom Line* reports are based on large

databases of projects, a lifecycle cost analysis can be undertaken using projections of costs and construction time while a system is still in early stages of development or consideration. In addition, the method could easily be used for other types of infrastructure investments, including transit systems, railroads and public utilities.

In summary, this model, while necessarily simplifying reality, helps to identify the system dynamics that affect the goal of achieving and maintaining a state of good repair, in this case, for the Interstate system. Reasonable conclusions to be inferred for policy purposes are the following:

1) The model predicts that the deferral of maintenance on the Interstate leads to higher costs, estimated at $9.5 billion per year, a premium of about 50% over lifecycle costs with proper maintenance.

2) The model predicts that maintenance and deferred maintenance burdens on the states have increased, and will continue to do so.

3) The model attempted to be conservative, and likely underestimated the size of the problem, because it does not account for the increasing cost of reconstructing highways while maintaining traffic flow on increasingly congested facilities.

4) Providing 90% federal funds for capital, while leaving maintenance to be funded 100% to the states, gives a perverse incentive to the states to prioritize their limited dollars for matching Federal capital funds, and to defer maintenance. Since states often can bond capital investment but must pay as they go for maintenance, the perverse incentive of that policy is even further exacerbated.

5) The recent FHWA policy decisions allowing preventative maintenance costs to be Federal-aid eligible through the Interstate Maintenance program can help to mitigate the problem for the Interstate system, but in states where operation and maintenance budgets are inadequate, one would expect that the perverse effects of underfunding maintenance will continue to worsen on the rest of the highway system.

6) It is therefore reasonable to conclude that expanding the recent reforms regarding preventative maintenance eligibility for the Interstates **to all the major categories of highway and transit**, and fully funding the consequently identified need, would be cost effective.

7) Since maintenance has traditionally been a responsibility assumed entirely by the states, a federal match of 50% (or even less) would be a significant improvement for the states, while still legitimizing federal leadership in maintenance management which was unsuccessfully attempted in the "unfunded mandates" of the 1991 ISTEA legislation.

Chapter 4: Policy Prescriptions

Introduction

The previous chapters have outlined a series of significant issues currently affecting the surface transportation program. The Highway Trust Fund is being exhausted of funds more quickly than revenues are collected, the federal program as currently established is unable to adequately address the growing needs of maintaining and reconstructing our nation's highways and transit systems, and the states are being forced to bear an ever growing burden to maintain highways of clear national significance. As the debate over the next transportation reauthorization commences in 2009 and 2010, the nation's leaders will have an opportunity to address these issues through fiscal and policy reform.

As a result, this chapter will focus on a series of policy prescriptions to attempt to address the above issues as informed by the cost trends and projections described in Chapter 3. These recommendations include changes to the structure of the Federal-aid program itself as well as an analysis of options to increase revenue to balance the Highway Trust Fund and to finance a needed increase in program authorization levels.

Changes to the Federal-aid Programs

The existing structure of the Federal-aid program, though altered significantly under ISTEA in 1991 – largely for the better – at its core still resembles the program as it was laid out in the 1940's and 50's to build this nation's primary highway network and the Interstates. Although the capital-expenditure restrictions of the Interstate 4R (now the Interstate Maintenance) program have gradually been lifted, much of the "federal-build, state-maintain" approach is still present in the program's structure and policies. It is becoming readily apparent, though, that the same system which was in the clear national interest to build in the 1950's is still clearly in the national interest to maintain fifty years later. In the same way that the states demonstrated that they were not prepared to build a network of

modern superhighways half a century ago without significant new federal funding, states likewise continue to demonstrate that they, acting alone, are not up to the task to maintaining the system we have today. Legislators should enact programmatic reform that helps to provide a focus for federal-aid dollars on the types of projects most appropriate for maintaining the system at particular points in its lifecycle. The following changes deserve consideration:

Program Consolidation

The Federal-aid highway program currently consists of 63 disparate initiatives each with their own discrete stream of funding. Many of these programs overlap and their focus becomes diminished by their sheer number. Additionally, the funds from many large programs can be easily exchanged by states to other accounts, further diminishing the program's ability to achieve distinct policy goals. As a result, these initiatives should be combined and retooled into a smaller number of larger, but specifically focused programs to address discrete investment needs, like System Maintenance, Reconstruction, Expansion or Safety. These programs would not be limited to the Interstate System, but would be applicable to all federal-aid eligible roads and transit systems. Funding for these programs should be matched to specific measures, like system lifecycle cost trends or performance metrics. In periods when an increased focus on system reconstruction is necessary, that program would be favored and when increased maintenance funds were needed, funds would be shifted there.

National Highway System Cost Estimate

In order to provide information to guide funding levels for these programs, Congress should consider re-introducing a revised version of the Interstate Cost Estimate (ICE) – the tool once used to calculate the state-by-state costs required to complete the Interstate Highway System. The ICE was then used by Congress to allocate funds to the states for work on the system based on need, rather than the result of a formula calculation. An initiative similar the ICE could be reconstituted to provide estimates of the current and future costs of system maintenance and reconstruction on the entire federal-aid

highway and transit systems helping to guide the most appropriate allocation of funds. The estimate would focus primarily on the needs of maintaining and reconstructing existing infrastructure before considering capacity additions and expansions.

Neither of these programmatic changes, however, will have much effect on the health and long term sustainability of the system without increased revenues and a significant rededication to providing full funding to the system.

Increasing Funding

As was illustrated in the previous sections, the biggest challenge to the federal program today is figuring out how to bridge the ever widening gap between revenues collected by existing mechanisms and current and future needs. The findings in Chapter 3 indicate a $7.2 billion annual shortfall in needed funding for the Interstate Highway System alone. At the same time, the source of the overwhelming majority of federal transportation dollars, the Highway Trust Fund – funded for the most part by fuel excise taxes – is being strained by lower demand for gasoline (resulting from rising fuel prices and technological changes), changing driver behavior and diminishing real value each fuel tax dollar. The account has already twice approached a negative balance and without a significant change in funding mechanism of the program, deferred maintenance will continue to rise and system performance will fall.

Though no solution is perfect, a number of potential alternatives are available to fill the significant shortfall that is looming. The section below will introduce the four most practicable solutions and provide a brief analysis of the relative advantages and disadvantages to implementation:

Fuel Excise Tax Increase

The first option before policymakers would simply be to work within the existing funding paradigm and raise federal fuel taxes to provide for anticipated funding needs. The current federal motor fuel tax

of 18.4 cents per gallon on gasoline and 24.4 cents per gallon on diesel fuel has not been increased since 1993—and thus the purchasing power of this tax has significantly eroded with inflation.[65] According to a report published by the Congressional Budget Office[66], the existing fuel taxes could be altered in a variety of ways to address this shortfall, including increasing the per-gallon tax rate and indexing the rates to inflation.

One could easily argue that this is the most pragmatic and perhaps the most intellectually consistent approach to addressing our transportation funding issues. The gas tax, after all, has been funding the federal transportation program for more than 75 years. A number of groups have already called for Congress to raise the federal gas tax, even alongside or in advance of alternative mechanisms. The report of the Policy Commission states that "while there is a growing consensus that alternatives to the fuel tax may be necessary in about 20 years, the fuel tax should remain an important component of surface transportation finance until viable alternatives are found." Likewise, a recent report published by the Transportation Research Board (TRB)[67] states that "fuel and vehicle excise taxes ... are likely to continue to be the mainstay of Federal and state funding programs" for the near future. According to the report, it should be a priority to ensure that these taxes "keep up with needs, including the inflation of costs" in order to close the funding gap. In order to cover the Interstate system funding gap illustrated in Chapter 3, it would require an increase in the fuel tax of only **5.3 cents per gallon** (though this represents unfulfilled needs in just one element of the surface transportation program).

Technical Feasibility

The technical feasibility of continued dependence on fuel excise taxes varies significantly over an extended time horizon. Enacting an increase to the federal gas tax enjoys few technical limitations because the framework for collecting the tax is already in place, but long-term reliance on fuel taxes is

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[65] Federal Highway Administration *Financing Federal-Aid Highways,*. Washington D.C., Appendix M.
[66] Congressional Budget Office. *Status of the Highway Trust Fund: 2007.* Washington D.C., March 2007.
[67] Transportation Research Board. *NCHRP 20-24(49): The Fuel Tax and Alternatives for Transportation Funding: Special Report 285*. National Academies, Washington D.C., 2006.

subject to a high level of uncertainty as to changes in the composition of future motor vehicle fleets. Fuel excise fees enjoy certain advantages that explain their rapid proliferation among the states in the 1920's and their long life as the central element of transportation finance in this nation. According to the Policy Commission report, among others, fuel taxes raise significant amounts of revenue, are easy to pay, collect, administer and audit, provide "relative stability and predictability" on income, are difficult to evade and are fundamentally private in nature.

Over the longer term, however, fuel taxes will be vulnerable to fuel efficiency improvements, the growth of alternative fuels and the introduction of alternative propulsion systems such as plug-in electric vehicles. According to a report published by the National Conference of State Legislatures[68], though the full effects of hybrid vehicles and alternatively fueled vehicles are unknown, hybrid vehicle sales are growing rapidly in the United States. The report cites a number of recent figures demonstrating the growth in hybrid vehicles. For example, according to ABI Research, sales of hybrid vehicles accounted for 10 percent of the 2 million midsize vehicles sold annually in the United States in 2006 and will account for 5 percent to 6 percent of all cars sold in the United States by 2010.[69]

However, despite the recent rapid growth of the hybrid electric auto market, the total segment of the motor fleet represented by these vehicles remains small – less than 1% of the 244 million publicly and privately-owned vehicles in the United States.[70] The relatively small number of hybrids produced thus far could limit could limit the implications of this technology shift on fuel tax revenues over the short term. However, as the vehicles become more attractive to consumers and less expensive to produce, this issue will become increasingly more significant.

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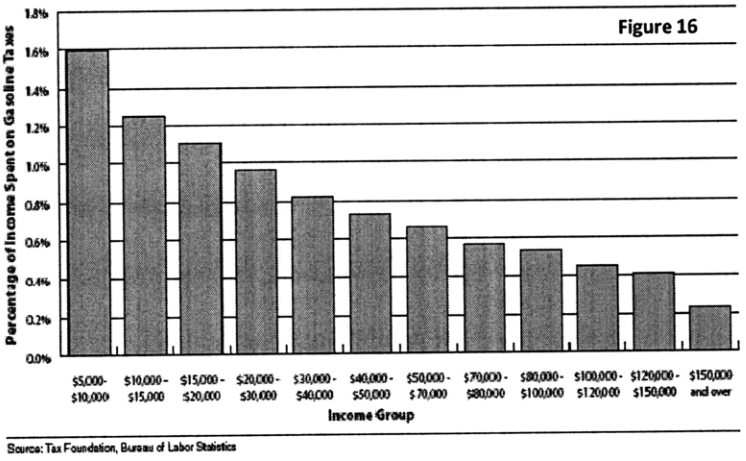
[68] National Conference of State Legislatures. *Surface Transportation Funding: Options for States.*. Denver, CO and Washington, D.C., May 2006.
[69] ABI Research. *Commercial Hybrid Vehicles Market Research Report*. New York, NY. October, 2006.
[70] Federal Highway Administration. *Highway Statistics 2006*. Washington D.C., 2006.

Equity Impacts

A number of different equity issues arise when evaluating transportation funding and finance mechanisms. Planners and policymakers evaluate equity between modes, equity between vehicle classification, geographical equity and equity between user income groups (among others). Typically, however, the most contentious and politically relevant issue in evaluating changes in tax systems is that of equity among income groups.

The excise tax on gasoline is generally viewed as regressive because the correlation between increased wealth and vehicle-miles travelled is less than unity. A family that earns twice as much money as another family generally does not drive or travel twice as far. As a result, the less wealthy family generally spends a higher percentage of their income on gasoline taxes than the wealthier family.



Different measures of tax equity seem to provide different results about how regressive the tax really is. When measured by annual surveys of consumer income compared to expenditures, some evidence shows that gasoline expenditures are clearly a larger fraction of income for very low income households than for middle or high-income households.[7172] However, studies based exclusively on calculations of the relative share of annual expenditure (without considering income explicitly) demonstrate that" low-expenditure households devote a smaller share of their budget to gasoline than

[71] Williams, Jonathan. *Paying at the Pump: Gasoline Taxes in America*. Tax Foundation. Washington D.C., October 2007.
[72] KPMG Peat Marwick. 1990.

do their counterparts in the middle of the expenditure distribution."[73] As a result, these studies generally find the gasoline tax to be less regressive.

A further consideration is that the gasoline tax is representing a small and decreasing proportion of gasoline prices at the pump, as world demand for petroleum increases in the face of finite supplies. This might indicate that the policy concern is modest and shrinking, though the political concern might grow.

Political Barriers

The gas tax was once seen as the "only popular tax" when it was established in the 1920's and 30's to fund new road construction. Since the tax has been packaged as being consistent with the *benefit principle of taxation*, which states that only the beneficiaries of a particular government program should have to pay for it, it was generally seen as fair. When the tax was conceived, users perceived the direct benefits of the fee in the form of a steady increase in road quality, capacity and performance. Users were comfortable with fuel tax increases in the 1950's because planners and policymakers were able to argue that the new taxes would provide drastic increases in terms of system performance and mobility in the form of the new Interstate Highway System. The fact that the Interstate program initially delivered net new dollars to every state helped to ensure the acceptability of the program.

However, since then, the spirit of the user fee principle has become obscured. As the transportation system has matured and the focus shifted from new construction to system preservation, many early-completion states lost the incentive to support the system, and the proliferation of earmarks to secure support for the program has tended to weaken the connection between users and payers. Regular investments do not necessarily correlate with significant increases in performance or quality and policymakers and advocates have largely failed in their efforts to tie the user fee principle to the more diffuse benefits of system reconstruction, maintenance, operation, and integration. These important

[73] Poterba, James. *Is the Gasoline Tax Regressive?* NBER Working Papers Series. National Bureau of Economic Research. Cambridge, MA, 1991.

tasks, however, represent the financing needs of the future. Advocates have likewise largely failed at demonstrating the significant user costs (in wasted time due to congestion and in increased vehicle wear) of poor maintenance. Still, there is at least a general correlation between use of the nation's roads, the taxes and fees paid on the vehicles and fuels consumed to gain access to the system, and the costs imposed to construct, operate and maintain that infrastructure. There may be ways to enlist the philosophical concept of the user fee to support achieving and maintaining a state of good repair.

VMT Fee Implementation

With the introduction of ever more fuel-efficient vehicles, such as gasoline-electric hybrids, and new alternative-fuel automobile technologies including compressed natural-gas and electric plug-ins, the future viability of the existing fuel excise tax-based funding paradigm may eventually be in jeopardy. One of the most commonly cited alternatives to the gas tax, which maintains the user-pays principle but is seemingly agnostic to vehicle propulsion technology is the vehicle-miles travelled (or VMT) fee.

Under a VMT fee scheme, motorists would be charged a fee for every mile driven in a vehicle rather than for the amount of gasoline consumed. This allows governments and road operators to assess user fees on drivers regardless of the type of fuel or propulsion technology utilized. VMT systems of varying levels of technological sophistication would be capable of collecting mileage data from various sources and reporting in either physical or electronic form. The fee charged can be flat or variable, depending on numerous factors such as the classification of roadway, the time of day, amount of congestion and the type of vehicle utilized. VMT systems could potentially vary from 'dumb' systems that charge a flat fee for all miles travelled and could rely on an odometer reading to 'advanced' systems that rely on sophisticated GPS readings and differentiate road pricing based on the costs associated with and the current demand for particular road segments in real time.

Technical Feasibility

The technology to make an advanced VMT system possible is already available on the market. Late model year cars already come shipped with fairly advanced computers capable of handling the vehicle's dynamic systems. Global Positioning System (GPS) technologies have matured to the point that receivers have become commonplace consumer items in auto navigation units, PDAs and cell phones. Low-power wireless communications technologies have also become commonplace. From the widespread 802.11 a/b/g/n WIFI technologies commonly utilized for high-bandwidth computer networking and the lower-power Bluetooth standard to Radio-Frequency (RF) technologies commonly utilized in vehicle transponders, the technologies are clearly available for inter-vehicle and vehicle-to-roadside sensor communications protocols. Additionally, most states and local municipalities now possess detailed, high resolution GIS databases of highways owned and managed by the jurisdiction in formats that can be easily read, indexed and compared with GIS readings to determine the characteristics of the roadway currently being travelled on.

Recent pilot programs have already begun to demonstrate the feasibility of VMT systems in more basic forms. In 2002, a group of state Departments of Transportation commissioned a University of Iowa study on the feasibility of mileage-based user fees. That study[74], and a parallel review of road-use metering and charging systems commissioned by the TRB Committee for the Study of the Long-Term Viability of Fuel Taxes for Transportation Finance[75], found that mileage-based fee systems were a feasible alternative to the fuel tax.

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[74] Forkenbrock, David J., and Jon G. Kuhl. *A New Approach to Assessing Road User Charges*. Iowa City, Iowa. The University of Iowa, July 2002.

[75] Committee for the Study of the Long-Term Viability of Fuel Taxes for Transportation Finance, Transportation Research Board, National Academies. *Review and Synthesis of Road-Use Metering and Charging Systems*. Washington D.C., March 2005.

Starting in 2006, the State of Oregon undertook an ambitious pilot program – the largest to date – to demonstrate the technical and administrative feasibility of implementing a mileage-based user fee.[76] Under the pilot project, the Oregon Department of Transportation (ODOT) equipped a limited number of vehicles with electronic odometers to record their mileage and report the information to specially equipped fuel pumps at local gas stations. At the pump, the stored mileage totals driven in each zone were electronically transferred to the station's sales system. The customer's bill then would be calculated by combining the mileage fee and the fuel purchase price (less the state fuel tax). Drivers that did not participate in the pilot simply paid for their gasoline at the standard rate (including the state fuel tax).

Participating vehicles were also equipped with a GPS unit to ensure that drivers were not taxed for miles driven outside the state. Out-of-state drivers paid normal gas tax rates at the regular gas pumps. The state found that the technology and system design is viable for wider implementation, privacy of the user can be protected and that "congestion and other pricing options" can be integrated into the program. Oregon also found that the cost of implementation and administration of the system is relatively low – with the bulk of costs coming from the mileage reader technology implementation, in-vehicle technology (which will be borne by the user as part of the vehicle price) and DOT administration.

Equity Impacts

The equity impacts of a VMT fee are not immediately apparent. Several analyses of the possible distributional consequences of such a scheme have indicated that the effects would be complex and would vary greatly depending on the characteristics of the system design and the utilization of revenues. For example, with a VMT scheme that integrated active road pricing, the distributional impacts would depend to a certain extent on existing travel patterns, transit alternatives in the area and how the

[76] State of Oregon. *Oregon's Mileage Fee Concept and Road User Fee Pilot Program – Final Report*. Salem, OR, 2007.

generated revenues are spent. A scheme in which funds were expended on improvement to the public transport system would likely have beneficial contributions to equity; a scheme in which a congestion-adjusted VMT fee simply replaced the existing fuel tax would likely serve to exacerbate equity concerns by serving to transfer funds from more congested areas to less congested areas.

VMT fees, particularly those that integrate congestion pricing, could have a disproportionate impact on the poor. One of the major purposes of VMT fees is to spread the peak of travel demand by assessing users more an accurate cost of travel for that time and place. There is a concern that increased costs would disproportionally affect those least able to pay and those with the lowest monetary value of time, notably the lower middle class and the working poor. Research remains mixed on how significant this effect would be.

Otherwise, preliminary studies have demonstrated that VMT fees are not appreciably more regressive than the existing fuel excise fee. A study done by researchers at Oregon State in tandem with that state's road pricing pilot demonstrated that the equity issues associated with a transition to a VMT would be fairly minimal.[77] The researchers stated that the switch would likely have a substantially smaller impact on driving than recent increases in gasoline prices. According to the report, different alternative VMT policies would have values of -.142, and -.145 on the Suits Index – a relative measure of collective tax progressivity. For comparison, the Suits Index of the .23¢ Oregon fuel tax is -.133.

Another study of comparative VMT tax equity also found the potential for VMT taxes to be more regressive than the fuel tax but stipulated that, when considered over lifetime expenditures, the effect was minimal.[78] This study compared the imposition of a VMT tax (among others) to the use of vehicle registration fees to account for environmental effects. When compared using a measure of annual income, the Suits Index of -0.15 for the VMT was significantly more regressive than the Suits Index of

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[77] McMullen, B. Starr; Zhang, Lei and Nakahara, Kyle. *Winners and Losers: Distributional Impacts of Highway User Fees*. Oregon State University. February, 2008.

[78] Walls, Margaret and Hanson, Jean. *Distributional Impacts of an Environmental Tax Shift: The Case of Motor Vehicle Emissions Taxes*. Discussion Paper 96-11. Resources for the Future. Washington D.C., February 1996.

-0.09 obtained for the registration fee. However, when compared using lifetime income (accounting for periods of life – such as youth or retirement – when income may be low but expenditures remain high), the VMT fee appears to be only very slightly regressive – "a poorest quintile household pays about 1.12 times what a household in the richest quintile pays." The Suits Index, on a lifetime income basis for the VMT fee is -0.06, compared to -0.03 for the vehicle registration fee.

Any VMT system that is designed to include elements of congestion pricing policies is likely to encounter some of the same political barriers that have made the implementation of cordon and open-road congestion pricing politically challenging. Just as with these other implementation strategies, there are likely to be significant numbers of travelers who would find themselves being charged more and traveling less under the auspices of a congestion pricing program. These are most likely to be travelers who have few alternatives with regard to mode choice, corridor choice, travel period or employment location. The strong outcry from this largely middle class constituency could alone serve as a significant obstacle. The implementation of mileage-based congestion pricing, however, holds significant promise as a means to greatly improve the speed, reliability, and ridership of bus transit on local arterials. Depending on how congestion pricing revenues were allocated, the additional transportation improvements could also be targeted to benefit lower-income households, negating some of the inherent equity concerns. By targeting revenues to increased transit service, the capacity of the transportation network can be expanded while the existing infrastructure stock is maintained – a solution to the excessive road use that is the root cause of congestion.

Privacy Concerns

The most significant political barriers to VMT implementation are concerns about privacy and the collection of vehicle travel information and the fear of equity issues in VMT systems that integrate congestion pricing.

Regarding privacy, some public advocates are concerned that VMT systems will give the government "an alarming ability to track a driver's location and movements." Although officials from the Oregon pilot program guaranteed participants explicitly that the program collects mileage data only and does not keep location information, more advanced systems could potentially give transportation officials information about the driver's miles traveled, travel inside and outside the state, and detailed information about the driver's in-state travel. Regulations and technological solutions could potentially be used to safeguard privacy and to quell public suspicions about the issue.

Environmental Issues

Lastly, some environmental groups also are concerned that VMT systems could eliminate an element of the current set of incentives to purchase more fuel efficient vehicles. Under the current tax structure, owners of fuel efficient vehicles pay less in federal taxes per mile driven than the average road user. This provides yet another monetary incentive for the purchase of hybrid-electric, plug-in and alternative fuel vehicles. Though a significant element of the argument in support of the transition to VMT fees is the fact that more fuel efficient vehicles do not pay "their fair share" of roadway costs, policymakers could potentially decide to keep such an incentive in place simply by implementing a user fee structure that differentiated between vehicle types, fuel use and propulsion technology.

Effectiveness

At the moment, the primary challenge facing the system is a lack of funding. Most of the discussion surrounding a VMT fee is as a total replacement for the current fuel excise taxes. To go through the difficult political process of overhauling the tax base entirely without achieving significant new revenue would be self-defeating. As a result, policymakers should consider introducing the VMT model in increments as a small addition to the current revenue base, rather than as a replacement to it.

Use of General Revenues

Another potential avenue for transportation funding is to simply allocate funds for the system from general revenues. This would likely involve adjusting personal and corporate income tax rates to provide increased revenues to cover the current funding shortfall and to counter the diminishing value of the fuel excise tax over time. This could be utilized as a solution to supplement existing revenue sources or a part of a plan to completely replace existing excise taxes.

Many states already fund a significant portion of their transportation programs from general revenues, in fact, five states depend on general revenues for more than 10% of their transportation spending.[79] General taxes already account for more than 25% of total federal, state and local transportation funding - $43.1 billion out of $168.2 billion in 2004.[80] Additionally, as mentioned above, prior to the establishment of the dedicated Highway Trust Fund in 1956, federal transportation programs were appropriated entirely from the general fund. Though one concern of once again relying on general fund revenues for transportation is the fact that such revenue is traditionally not exclusively dedicated (as HTF revenues are), there are legislative solutions to obviate that concern.

Technical Feasibility

This alternative suffers from no known technical barriers; the majority of other major federal-aid programs – such as Medicaid – are already appropriated from general revenues. Also, a small percentage of the federal transportation program – chiefly the New Starts program – is partially funded using general revenues.

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[79] *See supra note* 68

[80] Transportation Research Board. *Future Financing Options to Meet Highway and Transit Needs*, NCHRP Project 20-24(49). Interim Report. National Academies, Washington D.C., May 2006.

Equity Impacts

Utilizing the federal government's general revenues to fund the transportation system would have equity considerations equivalent to those of the current system of general taxation. Currently 68% percent of non-payroll tax federal receipts are collected from individual income taxes. The difference is derived from corporate income taxes, excise fees, customs duties and other fees. Contrary to the previously discussed taxes and fees, since its adoption the federal income tax has been reliably considered one of the most progressive taxes assessed in the United States (the Suits Index of the federal income tax is 0.344 [81]). Some researchers consider the progressivity of the personal income tax to be so significant that it offsets the regressivity of the other federal taxes (such as the fuel excise). [82] As a result, this alternative would have few 'technical' equity issues – though the political perception is a different matter.

Political Barriers

The problem with this alternative lies not in issues of technical feasibility or in the strict consideration of income equity but rather with other practical and political considerations. For one, funding more of the system from the general fund subverts the now-established concept of benefit taxation in the transportation system. As a result of this change, commuters and other highway travelers would experience even fewer of the costs associated with their utilization of the system than they do today. In the case of a complete replacement of existing revenue streams with general fund revenues, this could lead to a small, but measurable, increase in system demand, potentially effecting even greater congestion. Limited utilization of general fund revenues to bridge the funding gap, however, would likely not have a significant effect on system use. Additionally, many infrequent users of the

[81] Roach, Brian (Lead Author); S. Niggol Seo (Topic Editor). 2007. "Suits index." In: Encyclopedia of Earth. Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). [Published in the Encyclopedia of Earth January 21, 2007; Retrieved August 5, 2008].
[82] Blakely, Roy G. *The Federal Income Tax*. The Lawbook Exchange, Ltd., 2006. Pg. 569.

transportation system, such as urban dwellers, may also feel like they are being unjustly taxed in order to subsidize the travel costs of others.

Another issue to consider is the relative independence that the federal transportation system gains from having its own dedicated stream of revenue. In a situation where the transportation program was appropriated largely out of the general fund, the program would have to compete for funding on a regular basis with other governmental priorities such as healthcare, education and national defense. This could lead to significant changes to the amount of funds available to be appropriated to the transportation program. This inherent uncertainty would likely have disruptive effects on states' ability to plan for long term transportation programs and infrastructure improvements. There are ways, however, for Congress to craft legislation that provides regular general fund revenues – dedicated to transportation – for funding the federal-aid programs.

A short-term strategy of funding the gap in the next authorization based on transfers from the General Fund may be politically feasible if the increased transportation program expenditures were tied to a continued effort to stimulate the economy. This would serve to shift the political challenge over funding from the impact of increased taxes to the broader issue of deficit reduction.

Conclusion

As in all important policy decisions, there are a number of key factors to weigh in making the decision of to how to better organize the federal-aid program and how to fund its increasing needs. The decision on how to rearrange or cut existing programs will involve a largely political process of reprioritization. On the funding side, issues of privacy and technical feasibility will have to be weighed against the ability to collect enough revenue for the program and, just as importantly, the ability to garner adequate political support for reform. These debates will be difficult and will have to be informed by more detailed information about particular scenarios and particular technological solutions.

More importantly, perhaps than the details of negotiating how precisely these changes are accomplished, however, is that political leaders should begin to recognize the size and scale of the needs of the system and the fact that our surface transportation infrastructure requires a sustained, adequate and targeted effort. The construction of our nation's highway and transit system was not a one-time investment, rather the first 30 years of the program was simply a down payment on a system that provides inestimable value to the American people but requires regular reinvestment for its continued existence. The compelling case for a vision of achieving and maintaining a state of good repair in the nation's transportation systems must precede the effort to raise taxes to support that vision. Remembering the example of the Interstate program – Congress developed the framework for the program well before mustering the political will to pay for it.

Chapter 5: Concluding Thoughts

The intent of the previous four chapters, among other things, was to illustrate the effects of short-sighted decision-making and the ramifications of unintended consequences with respect to the surface transportation system in the United States. In as system so pervasive, so large and so complex, policy decisions – even simple ones – can have significant and long term effects on system performance, capacity and throughput, user safety and even broad measures of economic growth. In an effort to limit such costly mistakes, policy leaders need to work to make improvements to the existing decision-making process. Utilizing the current challenge to adequately fund the system and to achieve (and sustain) a state of good repair on this huge network provides an opportunity for Congress to transcend the simple tit-for-tat, earmark-laden negotiations that the reauthorization process has become.

Utilizing knowledge about the dynamic costs of existing infrastructure, the problems with the existing program structure and the gamut of possible new revenue sources, policymakers can utilize the upcoming (2009-2010) transportation reauthorization process to chart a new course. The potential exists for nuanced political leaders to use the current problems impacting the system to forge a new political coalition around the concept of system preservation. Transportation maintenance and reconstruction is one of those rare issues that affect practically every region, every state and every person in the nation, from the rich to the poor. Without a comprehensive solution to keeping the existing system in a state of good repair, congestion will increase, costs from vehicle wear and tear will rise and user safety on the transport system will continue to worsen.

As has been shown, the current problems with the federal program certainly do not represent the first time that governments in America have encountered unintended consequences in forming transportation policy. In the 1820's, following Madison's veto of the Bonus Bill, a number of individual states put their revenues and credit on the line to bolster canal companies while discounting the risk posed by a burgeoning new technology – the railroad. Many state treasuries suffered the consequences.

Much of the economic turmoil that resulted from these busts – which are alleged to have caused at least one recession – was due to a lack of cohesive national transportation policy that in effect promoted competition between the states and could have been averted by federal involvement. In another example, the federal government engaged in active promotion of new rural highways in the 1920's while simultaneously taking for granted the transit systems and urban road networks that growing metropolitan areas relied upon. It followed then, in the latter half of the 20th Century, that almost all of the largest transit systems, burdened by both industry-wide inefficiencies and competition from the federally-subsidized highways, were forced into bankruptcy and that direct federal involvement became necessary to save the systems.

It is now clear that the structure established during the 1950's that was so effective at constructing the Interstate Highway System – the largest and most complex single public infrastructure initiative this nation has ever undertaken – was poorly equipped to see to its continued maintenance. The political constituency and institutional structure formed to support system expansion has been, until now, unable to seamlessly transition into a guardianship role. As a result, a number of policy decisions established in the 1950's regarding system maintenance didn't change for decades and the continued politicization of funding distribution and excessive earmarking have undermined the federal-aid program's reputation as a smart investment. Now, our nation's highways are suffering from significant underinvestment and the backlog of needed improvements is constantly growing.

More than perhaps any other proposal to reform our nation's transport system, however, it should be possible to build a strong political coalition around the promise to keep the Interstate system, major interregional highways and transit systems in good repair. In addition to congestion, environmental effects and equity issues, the issue that is constant across nearly every state transportation department is the ongoing challenge to keep the system well maintained. Every state has highways and public transport systems and nearly every state, whether it is predominantly rural, urban or somewhere in between, has a backlog of important investment and maintenance initiatives that are critical to the

continued health of the system. If policymakers and advocates are to successfully build the political will to address the current problems and to improve the decision making process that will lead to other choices affecting the long term health of the system, however, they must begin to integrate the following considerations:

System Needs are Dynamic

Far too often, system needs are presented to legislators and to the public as a static number at the end of a spreadsheet. Looking at a single number, however, belies the complex interactions that produce that result. System needs are driven by the ongoing lifecycle costs of a large set of individual system elements each with its own designed useful life and regular costs associated with its upkeep. As a result, the system is constantly affected by the shadow effects of building booms in the past as waves of infrastructure begin to require repairs, upgrades or complete reconstruction. As a result, there are times in the infrastructure cycle when more maintenance funding is needed and times when more capital expenditures are required. Having a better grasp on the ebbs and flows of those cycles at a federal, state and even local level will help planners to stay ahead of the curve and avoid the expensive results of deferred maintenance.

Maintenance is Key

It may not be as politically attractive as bringing home a new bridge or highway to one's district, but responsible management of the current transportation system is essentially equivalent to ensuring that it is well maintained. Though targeted capacity enhancements are certainly important, almost all of the metrics of system performance – among them speed, throughput, safety and air quality – are in significant ways dependent on the quality of maintenance performed on the infrastructure. Reliable distribution of maintenance and reconstruction funds based on a transparent, needs-based process to all 50 states can provide a more sensible rationale to keep the public works constituencies unified and mobilized, replacing the excessive earmarks which now fill that function.

Program depends on Critical Thinking about the Future

Though the primary focus of this authorization cycle should be on state of good repair, it is also critically important that policymakers look at the emergence of congestion as a growing issue. Over 52 metropolitan areas – located in 38 of the 50 states – have exceeded 1 million in population and are the most affected by chronic congestion. After state of good repair, congestion presents the largest challenge to the daily performance of the transportation system. Additionally, in order to take proactive steps to address both maintenance and growing congestion, legislators, planners and transportation advocates must think critically about how rapidly evolving technologies will affect the utilization of, and the revenue sources for, the future surface transportation system:

- Will a shift away from fossil-fuel based automobiles – or a significant increase in their efficiency – lead to lesser or greater utilization of the nation's highway network?
- How quickly will the shift in technology undermine existing revenue streams – and how quickly can the system react to these changes?
- How will future efforts to combat global warming affect the future of the system? ...the highway/transit mode split? ...overall VMT?

These are the types of questions that policymakers must address and shape policy responses to as soon as is practicable. Engineers and advocates forecast that it will take at least a decade to transition from an excise tax-based system to another solution, such as VMT fees. As such, with guidance from the recent reports by the National Surface Transportation Policy and Revenue Study Commission and the National Surface Transportation Infrastructure Financing Commission, among others, Congress should begin to address the issue of long term funding reform as soon as the next reauthorization cycle. Though the top priority of the current transportation policy debate must be on the critical task of refocusing the program to address state of good repair and congestion – and providing for an infusion of general fund revenue might suffice to address the revenue needs of these programmatic changes – it would be unwise to postpone consideration of the long-term future of the transportation revenue base.

By making progressive steps to address both the long and short term revenue situation, taking care to balance the burden between the federal government and the states, by taking steps to promote and ensure regular maintenance of existing infrastructure and by making efforts to anticipate the effects of growing congestion and of changes in transportation technology, the federal program can experience a resurgence in efficacy and purpose. Legislators and policymakers have a chance during the 2009/2010 reauthorization debate to begin this important transition. To delay risks further expanding the list of backlogged projects and poorly-performing roadways. Significant reform is possible – though it will require determination and a sustained effort to build the political will. The same, however, was certainly true in the early 1950's as the pieces were falling together under President Eisenhower's leadership for the construction of the system that now bears his name. Just as then, when the citizenry watched in amazement as vast ribbons of roadway unfurled across the countryside, with renewed focus and newfound determination, the nation can once again be proud of the product of the federal transportation program.

Recommendations

The research that this thesis has explored – from the historical development of transportation policy, to the estimation of current systematic needs – leads to a series of recommendations:

1) Policymakers should definitively embrace the Gallatin principle – that the Federal government's role in transportation is to "lead where the other actors lack the ability, the resources, and the scope of action to accomplish the task." It has taken nearly two centuries to outgrow the need to justify transportation policy based on the postal service. The worst economic downturn since the 1930's confirms the need to focus on improved transportation system performance in all 50 states (for the Senate) and for the 85 metropolitan areas that are home to a significant majority of the American population and which are responsible for more than 73% of the American economy (for the House).

2) New legislation should further the progress towards multimodalism by including transit as well as highway funding in a new state of good repair initiative using a needs-based

distribution process similar to the old Interstate cost estimate. This would serve to project a new vision while reusing a successful past approach.

3) Advocates should begin to recognize the metropolitan regions that have generally been subsidizing the rural roads since 1916, through a new multimodal congestion management initiative, focused on where the emerging congestion is, and on the complex infrastructure rebuild projects that will be increasing as the oldest Interstates pass their 50th anniversary.

4) Consciously focusing on the need for not only an overarching policy vision, but also the institutional need to provide more money to all 50 states will help to enable practical reform – the revolutionary new Interstate highways were only built once a way was found to give states new revenues to pay for them.

5) Identify an incremental general fund stimulus approach to fund the next 6 years, if necessary, to provide time to develop a robust new funding strategy.

Chapter 6: Future Work

This work represents a slightly different way of viewing an old and continually evolving problem, serving to highlight the importance of thinking holistically about all elements of the nation's transportation system, from construction to system upkeep, from revenue generation to program structure, and how those discrete parts interact to cause and attempt to address systematic needs. This effort was built upon significant past work, including the efforts of Ann Friedlaender and the numerous analyses of the federal program conducted over the past decade by governmental commissions and advocacy groups. That said, much is yet to be done on this subject and there are a number of important directions for future work in helping to reform the federal surface transportation program:

Modeling Costs

Though the simple model utilized in thesis to model the dynamics of system costs is not meant to serve as a rigorous cost estimation tool, there are still a number of ways that it could be improved. Foremost, the model could be updated to integrate risk and uncertainty measures for both the cost values and the life-cycle schedules used for calculations. This would "smooth the curve" of the resulting cost estimates, providing a more realistic projection. It simply unrealistic to assume that all pieces of infrastructure have a fixed lifespan. In addition, the resolution of the projections could be increased by using detailed cost figures for each state – data that was not available for this study. It is also important to recognize that reconstructing aging infrastructure under conditions of heavy current utilization will entail significantly higher costs, and that separate data gathering is important for this substantially new challenge.

Other Modes

Though the greatest political consensus will likely first be around achieving a state of good repair on the nation's highways and then addressing the issue of chronic congestion, it is also important to address the needs of other modes and other infrastructure systems. The approach outlined in this work

would certainly apply to illustrating the needs of complex systems such as subways, light rail networks, bus systems and commuter railroads. By building on local and regional level estimates of need it should be possible to estimate the national funding gap for transit operations and upkeep as well as illustrating the changes in capital needs over time.

Addressing Congestion

The second most significant problem affecting the nation's highway system is that of chronic congestion in many of the nation's key metropolitan areas. As an increasingly metropolitan nation – the nation's largest 85 metro areas account for 73% of the nation's gross domestic product[83] – this problem has the potential to further limit regional mobility affecting employment opportunity, increasing the cost of trade, restricting economic growth and increasing environmental impacts. Though congestion represents a fundamentally different set of issues than state of good repair, it is possible to utilize parallel modeling approaches to that demonstrated in this work to illustrate the dynamics of congestion over time and investigate how the costs of addressing congestion are borne on all of the stakeholders involved in the surface transportation system – including federal, state and local governments and system users.

User Benefit of Good Repair

Though this thesis largely relies on the lifecycle costs of existing transportation infrastructure inventory to make the case for increased spending on system upkeep, it ignores an important factor in the equation – the user benefits of good repair. Keeping the system in good repair would have beneficial effects for system users on congestion, vehicle wear and tear and safety – all of which can potentially be quantified and valued. Future work should investigate these benefits more explicitly and integrate them into the analysis.

[83] *U.S. Metro Economies Report*. U.S. Conference of Mayors, Washington D.C. June, 2008.

Lower Federal Match

This analysis also holds static the current federal/state matching ratios that were a product of the 1956 consensus that funded the Interstate system. It may be time for a re-evaluation of the current matching levels. Why 90/10 and not some other percentage? Is there still a political consensus for static matching ratios at all? Perhaps matching ratios can be altered on a state by state basis to address to address donor/done inequities without the need for the now separate Equity Bonus program. What would the ramifications and long term effects of such a change likely be? Additional federal funds will leverage more state and local dollars and higher matching requirements can be used to reflect a greater share of local benefits from a project. Changes to the federal match can potentially increase the breadth and reach of the national program if political will can also be achieved at the state and local level. More research on this question will be needed. Since maintenance has long been considered a state and local responsibility, even a federal share of 50% or less would provide substantially more federal money to every state and would provide the basis for enforceable federal leadership on ensuring a state of good repair.

The Future of the User Fee Principle

Finally, it would be useful to quantify the historical implications and the continuing effects of seeming adherence to the user benefits principle in US transportation policy. This thesis makes mention of the general trend of subsidization of rural infrastructure by urban users (from 1916 through the Interstate era), however, there is relatively little quantitative research investigating the magnitude of this subsidy and its effects. More information about this effect could help to guide policymakers to either enact future reforms to more accurately apply the beneficiary principle or to decide that the principle has become archaic and unworkable.

Epilogue

As this work goes to print in mid-August of 2009, the debate over the future of the federal transportation program is as brisk and controversial as ever. Though the Chairman of the House Transportation and Infrastructure Committee, Rep. James Oberstar (D-MN), has been leading a sustained push to address transportation reauthorization this year, Congress has adjourned for the summer recess with the House and the Senate acting only to approve a transfer of $7 billion from the General Fund to the Highway Account of the Highway Trust Fund "to avert an immediate cash shortfall." With the Obama administration calling for an 18-month extension to the current program, backed by additional General Fund revenues and Oberstar insisting on tackling an overhaul of the transportation reform package this fall, there is significant uncertainty regarding the potential timing of congressional action between now and September 30, when existing program authority is due to expire.

According to an update of the status of the debate "on the hill" by noted public policy consultant and transportation advocate Ken Orski[84], "hope for a timely enactment of a long term transportation bill this year all but vanished when [Oberstar] acknowledged [in July] that he does not favor raising the gas tax" during the current recession to meet the funding levels needed under the new legislation. Both Oberstar in the House and leaders in the Senate are envisioning an approximately $500 billion transportation reauthorization package ($450 billion for highways and transit, $50 billion for high-speed rail) for the next six years.

As a result, other potential sources of revenue have begun to enter the debate. Peter DeFazio (D-OR), chairman of the Highways and Transit Subcommittee, suggested "imposing a fee on barrels of imported and domestic crude oil and the taxing crude oil futures transactions" as well as a number of more short-term solutions. Discussion is also building on the possibility of using a windfall profits tax on producers of motor fuels to help supplement the gas tax. According to Orski, however "none of the

[84] Via personal correspondence: C. Kenneth Orski. *What Can We Expect from Congress in September? Aug 10, 2009.*

options... come near to raising the $214 billion in additional revenue needed to finance the six-year program." With statements from the Obama administration implying that the President will not support any new revenue sources at this time, the state of the program stands in limbo.

At the same time, the evolving crisis in nearly all of the nation's major transit systems raises the spectre of backsliding on the already tenuous state of good repair and loss of service in the transit system – worsening congestion, degrading mobility, and exacerbating environmental impacts. Continued increases in the unemployment rate – even as the stock markets improve – makes it clear that the desirability of a job generating economic stimulus will continue for some period of time. By using the issue of system preservation to build the political consensus for addressing the revenue issue and introducing programmatic reform, congressional leaders and policymakers have a clear direction forward to renewing the purpose and the direction of the federal program.

Appendix

Extent of Constructed System: Interstate Highway Program

Year	Miles Opened During Year	Cumulative Miles Opened	% of Chargable Miles Open	Chargable Miles
Pre-1956	2,180.50	2,180.50	5.1%	40,000
1956	538.8	2,719.30	6.4%	41,000
1957	2,232.70	4,952.00	11.6%	41,000
1958	1,794.90	6,746.90	15.8%	41,000
1959	1,895.40	8,642.30	20.2%	41,000
1960	1,797.60	10,439.90	24.4%	41,000
1961	1,856.50	12,296.40	28.7%	41,000
1962	2,039.40	14,335.80	33.5%	41,000
1963	2,219.60	16,555.40	38.7%	41,000
1964	2,463.40	19,018.80	44.4%	41,000
1965	2,166.00	21,184.80	49.5%	41,000
1966	2,290.80	23,475.60	54.9%	41,000
1967	2,166.30	25,641.90	59.9%	41,000
1968	1,962.30	27,604.20	64.5%	41,000
1969	2,033.50	29,637.70	69.3%	42,500
1970	1,905.70	31,543.40	73.7%	42,500
1971	1,444.30	32,987.70	77.1%	42,500
1972	1,405.60	34,393.30	80.4%	42,500
1973	1,067.20	35,460.50	82.9%	42,500
1974	812.1	36,272.60	84.8%	42,500
1975	1,119.50	37,392.10	87.4%	42,500
1976	790.3	38,182.40	89.2%	42,500
1977	724.5	38,906.90	90.9%	42,500
1978	505.4	39,412.30	92.1%	42,500
1979	365.2	39,777.50	93.0%	42,500
1980	475.2	40,252.70	94.1%	42,500
1981	381.6	40,634.30	95.0%	42,500
1982	235.4	40,869.70	95.5%	42,500
1983	114.2	40,983.90	95.8%	42,500
1984	345.6	41,329.50	96.6%	42,500
1985	159.1	41,488.60	96.9%	42,500
1986	173	41,661.60	97.4%	42,500
1987	197.6	41,859.20	97.8%	42,500
1988	145.2	42,004.40	98.2%	42,500
1989	432.2	42,436.60	99.2%	42,500
1990	95.6	42,532.20	99.4%	42,500
1991	64.5	42,596.70	99.5%	43,000
1992	95.3	42,692.00	99.8%	43,000
1993	49.7	42,741.70	99.9%	43,000
1994	7.6	42,749.30	99.9%	43,000
1995	15.1	42,764.40	99.9%	43,000
	"Chargable" System Extent:	42,794.50		

Source: *Federal Highway Administration*

42,843: Includes original mileage authorized by former 23 USC 103(e)(1), Howard-Cramer additions authorized by former 23 USC 103(e)(2), and 1,500 additional miles authorized by former 23 USC 103(e)(3). This mileage includes toll roads and certain free roads incorporated into the Interstate System.
3,546: Mileage added to the System under former 23 USC 139(a) and new 23 USC 103(c)(4)(A) without Federal Interstate Construction funding.
337: Mileage added to the System under Section 1105(c)(5) of the ISTEA, as amended, without Federal Interstate Construction funding.
46,726: Total Miles

Construction Costs for a Single Lane-Mile of Expressway

State Name	Construction Cost	Right of Way	Environ Permitting	Environ Mitigaton	State Wage Law	PE %	CE %	Mob. %
Mississippi	$1,033,576	11-20%	0-10%	0-10%	No	No Data	5%	5%
Montana	$1,118,827	0-10%	0-10%	0-10%	Yes	<10%	10%	8%
Wyoming	$1,261,046	11-20%	0-10%	0-10%	Yes	10%	12%	8%
Arizona	$1,295,908	>30%	11-20%	11-20%	No	8%	15%	10%
Ohio	$1,330,176	11-20%	0-10%	0-10%	Yes	10%	8%	3%
Washington	$1,445,662	0-10%	0-10%	11-20%	Yes	15%	15%	10%
Illinois	$1,398,314	0-10%	0-10%	0-10%	Yes	10%	12%	3%
Michigan	$1,454,462	>30%	11-20%	11-20%	Yes	8%	0-15%	5%
New Mexico	$1,526,631	>30%	0-10%	0-10%	Yes	8-10%	15-20%	10%
Oklahoma	$1,510,910	11-20%	0-10%	0-10%	No	5%	9%	3%
South Dakota	$1,616,581	0-10%	0-10%	0-10%	Yes	4%	10%	10%
North Carolina	$1,590,182	>30%	0-10%	0-10%	Yes	10%	5%	
West Virginia	$1,572,946	11-20%	0-10%	0-10%	Yes	15%	18%	1%
Kansas	$1,914,917	11-20%	0-10%	0-10%	No	7%	10%	6%
Louisiana	$2,015,042	Varies	0-10%	0-10%	No	15%	4%	5%
Oregon	$2,112,486	11-20%	0-10%	0-10%	Yes	12%	No Data	10%
Idaho	$2,178,689	>30%	0-10%	0-10%	No	10%	10%	10%
California	$2,213,519	0-10%	0-10%	0-10%	Yes	20%	15%	10%
Arkansas	$2,257,449	11-20%	0-10%	0-10%	Yes	10%	10%	10%
Massachusetts	$3,069,336	Varies	0-10%	0-10%	Yes	10%	10%	0%
Maine	$3,594,823	0-10%	0-10%	0-10%	No	9%	10%	8%
New Jersey	$4,787,288	11-20%	0-10%	0-10%	Yes	15%	10%	10%
Hawaii	$5,942,278	11-20%	11-20%	0-10%	Yes	10%	15%	10%
New York	$8,461,288	No Data	No Data	No Data	Yes	5%	10%	4%
Colorado	$1,602,251	No Data	0-10%	11-20%	No	11%	11%	5%

Average Const. Cost: $2,332,183 per lane mile

Source: Washington State Department of Transportation

In 2006 Dollars

Estimated Life-Cycle Costs for a Single Lane Mile of State Highway

Well Maintained

Includes annual preventative maintenance activities (sealing cracks, repairing pavement, cleaning and repairing drains), regular resealing and a mid-life resurfacing for a "well-maintained" road.

	Construction						Resealing								Resurfacing						Resealing							Resealing		
Costs ($1,000s)\Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Preventative Maint.	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Seal Coats	0	0	0	0	0	0	80	0	0	0	0	0	0	0	0	0	0	0	0	0	80	0	0	0	0	0	0	80	0	0
Resurfacing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction / Reconstruction	2,610	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Costs:	**2,630**	**20**	**20**	**20**	**20**	**20**	**100**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**820**	**20**	**20**	**20**	**20**	**20**	**100**	**20**	**20**	**20**	**20**	**20**	**20**	**100**	**20**	**20**

Total Cost (in base $): $ *4,250,000* for 30 years of service

Poorly Maintained

Annual preventative maintenance activities deferred to every third year prompts resealing every fifth year, resurfacing at 10 years and shortens the lifespan of the road to 20 years.

	Construction			Resealing						Resurfacing						Resealing					
Costs ($1,000s)\Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Preventative Maint.	0	0	20	0	0	20	0	0	20	0	0	20	0	0	20	0	0	20	0	0
Seal Coats	0	0	0	0	80	0	0	0	0	0	0	0	0	0	80	0	0	0	0	0
Resurfacing	0	0	0	0	0	0	0	0	0	800	0	0	0	0	0	0	0	0	0	0
Construction / Reconstruction	2,610	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Costs:	**2,610**	**0**	**20**	**0**	**80**	**20**	**0**	**0**	**20**	**800**	**0**	**20**	**0**	**0**	**100**	**0**	**0**	**20**	**0**	**0**

Total Cost (in base $): $ *3,690,000* for 20 years of service

Consumer Price Index (CPI-U)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Avg.	Percent Change Dec-Dec	Percent Change Avg-Avg
1913	9.8	9.8	9.8	9.8	9.7	9.8	9.9	9.9	10	10	10.1	10	9.9		
1914	10	9.9	9.9	9.8	9.9	9.9	10	10.2	10.2	10.1	10.2	10.1	10	1	1
1915	10.1	10	9.9	10	10.1	10.1	10.1	10.1	10.1	10.2	10.3	10.3	10.1	2	1
1916	10.4	10.4	10.5	10.6	10.7	10.8	10.8	10.9	11.1	11.3	11.5	11.6	10.9	12.6	7.9
1917	11.7	12	12	12.6	12.8	13	12.8	13	13.3	13.5	13.5	13.7	12.8	18.1	17.4
1918	14	14.1	14	14.2	14.5	14.7	15.1	15.4	15.7	16	16.3	16.5	15.1	20.4	18
1919	16.5	16.2	16.4	16.7	16.9	16.9	17.4	17.7	17.8	18.1	18.5	18.9	17.3	14.5	14.6
1920	19.3	19.5	19.7	20.3	20.6	20.9	20.8	20.3	20	19.9	19.8	19.4	20	2.6	15.6
1921	19	18.4	18.3	18.1	17.7	17.6	17.7	17.7	17.5	17.5	17.4	17.3	17.9	-10.8	-10.5
1922	16.9	16.9	16.7	16.7	16.7	16.7	16.8	16.6	16.6	16.7	16.8	16.9	16.8	-2.3	-6.1
1923	16.8	16.8	16.8	16.9	16.9	17	17.2	17.1	17.2	17.3	17.3	17.3	17.1	2.4	1.8
1924	17.3	17.2	17.1	17	17	17	17.1	17	17.1	17.2	17.2	17.3	17.1	0	0
1925	17.3	17.2	17.3	17.2	17.3	17.5	17.7	17.7	17.7	17.7	18	17.9	17.5	3.5	2.3
1926	17.9	17.9	17.8	17.9	17.8	17.7	17.5	17.4	17.5	17.6	17.7	17.7	17.7	-1.1	1.1
1927	17.5	17.4	17.3	17.3	17.4	17.6	17.3	17.2	17.3	17.4	17.3	17.3	17.4	-2.3	-1.7
1928	17.3	17.1	17.1	17.1	17.2	17.1	17.1	17.1	17.3	17.2	17.2	17.1	17.1	-1.2	-1.7
1929	17.1	17.1	17	16.9	17	17.1	17.3	17.3	17.3	17.3	17.3	17.2	17.1	0.6	0
1930	17.1	17	16.9	17	16.9	16.8	16.6	16.5	16.6	16.5	16.4	16.1	16.7	-6.4	-2.3
1931	15.9	15.7	15.6	15.5	15.3	15.1	15.1	15.1	15	14.9	14.7	14.6	15.2	-9.3	-9
1932	14.3	14.1	14	13.9	13.7	13.6	13.6	13.5	13.4	13.3	13.2	13.1	13.7	-10.3	-9.9
1933	12.9	12.7	12.6	12.6	12.6	12.7	13.1	13.2	13.2	13.2	13.2	13.2	13	0.8	-5.1
1934	13.2	13.3	13.3	13.3	13.3	13.4	13.4	13.4	13.6	13.5	13.5	13.4	13.4	1.5	3.1
1935	13.6	13.7	13.7	13.8	13.8	13.7	13.7	13.7	13.7	13.7	13.8	13.8	13.7	3	2.2
1936	13.8	13.8	13.7	13.7	13.7	13.8	13.9	14	14	14	14	14	13.9	1.4	1.5
1937	14.1	14.1	14.2	14.3	14.4	14.4	14.5	14.5	14.6	14.6	14.5	14.4	14.4	2.9	3.6
1938	14.2	14.1	14.1	14.2	14.1	14.1	14.1	14.1	14.1	14	14	14	14.1	-2.8	-2.1
1939	14	13.9	13.9	13.8	13.8	13.8	13.8	13.8	14.1	14	14	14	13.9	0	-1.4
1940	13.9	14	14	14	14	14.1	14	14	14	14	14	14.1	14	0.7	0.7
1941	14.1	14.1	14.2	14.3	14.4	14.7	14.7	14.9	15.1	15.3	15.4	15.5	14.7	9.9	5
1942	15.7	15.8	16	16.1	16.3	16.3	16.4	16.5	16.5	16.7	16.8	16.9	16.3	9	10.9
1943	16.9	16.9	17.2	17.4	17.5	17.5	17.4	17.3	17.4	17.4	17.4	17.4	17.3	3	6.1
1944	17.4	17.4	17.4	17.5	17.5	17.6	17.7	17.7	17.7	17.7	17.7	17.8	17.6	2.3	1.7
1945	17.8	17.8	17.8	17.8	17.9	18.1	18.1	18.1	18.1	18.1	18.1	18.2	18	2.2	2.3
1946	18.2	18.1	18.3	18.4	18.5	18.7	19.8	20.2	20.4	20.8	21.3	21.5	19.5	18.1	8.3
1947	21.5	21.5	21.9	21.9	21.9	22	22.2	22.5	23	23	23.1	23.4	22.3	8.8	14.4
1948	23.7	23.5	23.4	23.8	23.9	24.1	24.4	24.5	24.5	24.4	24.2	24.1	24.1	3	8.1
1949	24	23.8	23.8	23.9	23.8	23.9	23.7	23.8	23.9	23.7	23.8	23.6	23.8	-2.1	-1.2
1950	23.5	23.5	23.6	23.6	23.7	23.8	24.1	24.3	24.4	24.6	24.7	25	24.1	5.9	1.3
1951	25.4	25.7	25.8	25.8	25.9	25.9	25.9	25.9	26.1	26.2	26.4	26.5	26	6	7.9
1952	26.5	26.3	26.3	26.4	26.4	26.5	26.7	26.7	26.7	26.7	26.7	26.7	26.5	0.8	1.9
1953	26.6	26.5	26.6	26.6	26.7	26.8	26.8	26.9	26.9	27	26.9	26.9	26.7	0.7	0.8
1954	26.9	26.9	26.9	26.8	26.9	26.9	26.9	26.9	26.8	26.8	26.8	26.7	26.9	-0.7	0.7
1955	26.7	26.7	26.7	26.7	26.7	26.7	26.8	26.8	26.9	26.9	26.9	26.8	26.8	0.4	-0.4
1956	26.8	26.8	26.8	26.9	27	27.2	27.4	27.3	27.4	27.5	27.5	27.6	27.2	3	1.5
1957	27.6	27.7	27.8	27.9	28	28.1	28.3	28.3	28.3	28.3	28.4	28.4	28.1	2.9	3.3
1958	28.6	28.6	28.8	28.9	28.9	28.9	29	28.9	28.9	28.9	29	28.9	28.9	1.8	2.8
1959	29	28.9	28.9	29	29	29.1	29.2	29.2	29.3	29.4	29.4	29.4	29.1	1.7	0.7
1960	29.3	29.4	29.4	29.5	29.5	29.6	29.6	29.6	29.6	29.8	29.8	29.8	29.6	1.4	1.7
1961	29.8	29.8	29.8	29.8	29.8	29.8	30	29.9	30	30	30	30	29.9	0.7	1
1962	30	30.1	30.1	30.2	30.2	30.2	30.3	30.3	30.4	30.4	30.4	30.4	30.2	1.3	1
1963	30.4	30.4	30.5	30.5	30.5	30.6	30.7	30.7	30.7	30.8	30.8	30.9	30.6	1.6	1.3
1964	30.9	30.9	30.9	30.9	30.9	31	31.1	31	31.1	31.1	31.2	31.2	31	1	1.3
1965	31.2	31.2	31.3	31.4	31.4	31.6	31.6	31.6	31.6	31.7	31.7	31.8	31.5	1.9	1.6
1966	31.8	32	32.1	32.3	32.3	32.4	32.5	32.7	32.7	32.9	32.9	32.9	32.4	3.5	2.9
1967	32.9	32.9	33	33.1	33.2	33.3	33.4	33.5	33.6	33.7	33.8	33.9	33.4	3	3.1
1968	34.1	34.2	34.3	34.4	34.5	34.7	34.9	35	35.1	35.3	35.4	35.5	34.8	4.7	4.2
1969	35.6	35.8	36.1	36.3	36.4	36.6	36.8	37	37.1	37.3	37.5	37.7	36.7	6.2	5.5
1970	37.8	38	38.2	38.5	38.6	38.8	39	39	39.2	39.4	39.6	39.8	38.8	5.6	5.7
1971	39.8	39.9	40	40.1	40.3	40.6	40.7	40.8	40.8	40.9	40.9	41.1	40.5	3.3	4.4
1972	41.1	41.3	41.4	41.5	41.6	41.7	41.9	42	42.1	42.3	42.4	42.5	41.8	3.4	3.2
1973	42.6	42.9	43.3	43.6	43.9	44.2	44.3	45.1	45.2	45.6	45.9	46.2	44.4	8.7	6.2
1974	46.6	47.2	47.8	48	48.6	49	49.4	50	50.6	51.1	51.5	51.9	49.3	12.3	11
1975	52.1	52.5	52.7	52.9	53.2	53.6	54.2	54.3	54.6	54.9	55.3	55.5	53.8	6.9	9.1
1976	55.6	55.8	55.9	56.1	56.5	56.8	57.1	57.4	57.6	57.9	58	58.2	56.9	4.9	5.8
1977	58.5	59.1	59.5	60	60.3	60.7	61	61.2	61.4	61.6	61.9	62.1	60.6	6.7	6.5
1978	62.5	62.9	63.4	63.9	64.5	65.2	65.7	66	66.5	67.1	67.4	67.7	65.2	9	7.6

1979	68.3	69.1	69.8	70.6	71.5	72.3	73.1	73.8	74.6	75.2	75.9	76.7	72.6	13.3	11.3
1980	77.8	78.9	80.1	81	81.8	82.7	82.7	83.3	84	84.8	85.5	86.3	82.4	12.5	13.5
1981	87	87.9	88.5	89.1	89.8	90.6	91.6	92.3	93.2	93.4	93.7	94	90.9	8.9	10.3
1982	94.3	94.6	94.5	94.9	95.8	97	97.5	97.7	97.9	98.2	98	97.6	96.5	3.8	6.2
1983	97.8	97.9	97.9	98.6	99.2	99.5	99.9	100.2	100.7	101	101.2	101.3	99.6	3.8	3.2
1984	101.9	102.4	102.6	103.1	103.4	103.7	104.1	104.5	105	105.3	105.3	105.3	103.9	3.9	4.3
1985	105.5	106	106.4	106.9	107.3	107.6	107.8	108	108.3	108.7	109	109.3	107.6	3.8	3.6
1986	109.6	109.3	108.8	108.6	108.9	109.5	109.5	109.7	110.2	110.3	110.4	110.5	109.6	1.1	1.9
1987	111.2	111.6	112.1	112.7	113.1	113.5	113.8	114.4	115	115.3	115.4	115.4	113.6	4.4	3.6
1988	115.7	116	116.5	117.1	117.5	118	118.5	119	119.8	120.2	120.3	120.5	118.3	4.4	4.1
1989	121.1	121.6	122.3	123.1	123.8	124.1	124.4	124.6	125	125.6	125.9	126.1	124	4.6	4.8
1990	127.4	128	128.7	128.9	129.2	129.9	130.4	131.6	132.7	133.5	133.8	133.8	130.7	6.1	5.4
1991	134.6	134.8	135	135.2	135.6	136	136.2	136.6	137.2	137.4	137.8	137.9	136.2	3.1	4.2
1992	138.1	138.6	139.3	139.5	139.7	140.2	140.5	140.9	141.3	141.8	142	141.9	140.3	2.9	3
1993	142.6	143.1	143.6	144	144.2	144.4	144.4	144.8	145.1	145.7	145.8	145.8	144.5	2.7	3
1994	146.2	146.7	147.2	147.4	147.5	148	148.4	149	149.4	149.5	149.7	149.7	148.2	2.7	2.6
1995	150.3	150.9	151.4	151.9	152.2	152.5	152.5	152.9	153.2	153.7	153.6	153.5	152.4	2.5	2.8
1996	154.4	154.9	155.7	156.3	156.6	156.7	157	157.3	157.8	158.3	158.6	158.6	156.9	3.3	3
1997	159.1	159.6	160	160.2	160.1	160.3	160.5	160.8	161.2	161.6	161.5	161.3	160.5	1.7	2.3
1998	161.6	161.9	162.2	162.5	162.8	163	163.2	163.4	163.6	164	164	163.9	163	1.6	1.6
1999	164.3	164.5	165	166.2	166.2	166.2	166.7	167.1	167.9	168.2	168.3	168.3	166.6	2.7	2.2
2000	168.8	169.8	171.2	171.3	171.5	172.4	172.8	172.8	173.7	174	174.1	174	172.2	3.4	3.4
2001	175.1	175.8	176.2	176.9	177.7	178	177.5	177.5	178.3	177.7	177.4	176.7	177.1	1.6	2.8
2002	177.1	177.8	178.8	179.8	179.8	179.9	180.1	180.7	181	181.3	181.3	180.9	179.9	2.4	1.6
2003	181.7	183.1	184.2	183.8	183.5	183.7	183.9	184.6	185.2	185	184.5	184.3	184	1.9	2.3
2004	185.2	186.2	187.4	188	189.1	189.7	189.4	189.5	189.9	190.9	191	190.3	188.9	3.3	2.7
2005	190.7	191.8	193.3	194.6	194.4	194.5	195.4	196.4	198.8	199.2	197.6	196.8	195.3	3.4	3.4
2006	198.3	198.7	199.8	201.5	202.5	202.9	203.5	203.9	202.9	201.8	201.5	201.8	201.6	2.5	3.2
2007	202.416	203.499	205.352	206.686	207.949	208.352	208.299	207.917	208.49	208.936	210.177	210.036	207.342	4.1	2.8
2008	211.08	211.693	213.528	214.823	216.632	218.815	219.964	219.086	218.783	216.573	212.425	210.228	215.303	0.1	3.8
2009	211.143	212.193	212.709	213.24	213.856	215.693									

Per Mile Cost Matrix for a Four Lane Highway in Constant 2006 Dollars

In Thousands of Dollars

Year	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Miles Built	539	2233	1795	1895	1798	1857	2039	2220	2463	2166	2291	2166	1962	2034	1906	1444	1406	1067	812	1120	790	725	505	365	475	382	235	114	346	159	173	198	145	432	96	65	95	50	8	15
1956	10520																																							
1957	80	10520																																						
1958	80	80	10520																																					
1959	80	80	80	10520																																				
1960	80	80	80	80	10520																																			
1961	80	80	80	80	80	10520																																		
1962	400	80	80	80	80	80	10520																																	
1963	80	400	80	80	80	80	80	10520																																
1964	80	80	400	80	80	80	80	80	10520																															
1965	80	80	80	400	80	80	80	80	80	10520																														
1966	80	80	80	80	400	80	80	80	80	80	10520																													
1967	80	80	80	80	80	400	80	80	80	80	80	10520																												
1968	80	80	80	80	80	80	400	80	80	80	80	80	10520																											
1969	80	80	80	80	80	80	80	400	80	80	80	80	80	10520																										
1970	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520																									
1971	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520																								
1972	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520																							
1973	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520																						
1974	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520																					
1975	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520																				
1976	400	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520																			
1977	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520																		
1978	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520																	
1979	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520																
1980	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520															
1981	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520														
1982	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520													
1983	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520												
1984	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520											
1985	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520										
1986	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520									
1987	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520								
1988	80	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520							
1989	80	80	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520						
1990	80	80	80	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520					
1991	80	80	80	80	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	400	80	80	80	80	80	80	10520					
1992	400	80	80	80	80	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	10520				
1993	80	400	80	80	80	80	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	10520			
1994	80	80	400	80	80	80	80	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	400	80	80	80	80	80	10520		
1995	80	80	80	400	80	80	80	80	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	400	80	80	80	80	80	10520	
1996	80	80	80	80	400	80	80	80	80	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	400	80	80	80	80	80	80
1997	80	80	80	80	80	400	80	80	80	80	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	400	80	80	80	80	80
1998	80	80	80	80	80	80	400	80	80	80	80	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	400	80	80	80	80
1999	80	80	80	80	80	80	80	400	80	80	80	80	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	400	80	80	80
2000	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	400	80	80
2001	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	80	400
2002	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	80
2003	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80
2004	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80	80
2005	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80	80
2006	400	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80	80
2007	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80	80
2008	80	80	400	80	80	80	80	80	3280	80	80	80	80	80	80	80	400	80	80	80	80	80	10520	80	80	400	80	80	80	80	80	80	400	80	80	80	80	80	3280	80

Per Mile Cost Matrix for a Four Lane Highway in Nominal Dollars

In Thousands of Dollars

Year	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Miles Built	539	2233	1795	1895	1798	1857	2039	2220	2463	2166	2291	2166	1962	2034	1906	1444	1406	1067	812	1120	790	725	505	365	475	382	235	114	346	159	173	198	145	432	96	65	95	50	8	15
1956	1419.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1957	11.2	1466.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1958	11.5	11.5	1508.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1959	11.5	11.5	11.5	1518.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1960	11.7	11.7	11.7	11.7	1544.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1961	11.9	11.9	11.9	11.9	11.9	1560.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1962	59.9	12.0	12.0	12.0	12.0	12.0	1575.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1963	12.1	60.7	12.1	12.1	12.1	12.1	12.1	1596.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1964	12.3	12.3	61.5	12.3	12.3	12.3	12.3	12.3	1617.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1965	12.5	12.5	12.5	62.5	12.5	12.5	12.5	12.5	12.5	1643.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1966	12.9	12.9	12.9	12.9	64.3	12.9	12.9	12.9	12.9	12.9	1690.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1967	13.3	13.3	13.3	13.3	13.3	66.3	13.3	13.3	13.3	13.3	13.3	1742.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1968	13.8	13.8	13.8	13.8	13.8	13.8	69.0	13.8	13.8	13.8	13.8	13.8	1816.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1969	14.6	14.6	14.6	14.6	14.6	14.6	14.6	72.8	14.6	14.6	14.6	14.6	14.6	1915.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1970	631.3	15.4	15.4	15.4	15.4	15.4	15.4	15.4	77.0	15.4	15.4	15.4	15.4	15.4	2024.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1971	16.1	658.9	16.1	16.1	16.1	16.1	16.1	16.1	16.1	80.4	16.1	16.1	16.1	16.1	16.1	2113.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1972	16.6	16.6	680.1	16.6	16.6	16.6	16.6	16.6	16.6	16.6	82.9	16.6	16.6	16.6	16.6	16.6	2181.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1973	17.6	17.6	17.6	722.4	17.6	17.6	17.6	17.6	17.6	17.6	17.6	88.1	17.6	17.6	17.6	17.6	17.6	2316.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1974	19.6	19.6	19.6	19.6	802.1	19.6	19.6	19.6	19.6	19.6	19.6	19.6	97.8	19.6	19.6	19.6	19.6	19.6	2572.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1975	21.3	21.3	21.3	21.3	21.3	875.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	106.7	21.3	21.3	21.3	21.3	21.3	2807.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1976	112.9	22.6	22.6	22.6	22.6	22.6	925.8	22.6	22.6	22.6	22.6	22.6	22.6	22.6	112.9	22.6	22.6	22.6	22.6	22.6	2969.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1977	24.0	120.2	24.0	24.0	24.0	24.0	24.0	986.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	120.2	24.0	24.0	24.0	24.0	24.0	3162.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1978	25.9	25.9	129.4	25.9	25.9	25.9	25.9	25.9	1060.8	25.9	25.9	25.9	25.9	25.9	25.9	25.9	129.4	25.9	25.9	25.9	25.9	25.9	3402.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1979	28.8	28.8	28.8	144.0	28.8	28.8	28.8	28.8	28.8	1181.2	28.8	28.8	28.8	28.8	28.8	28.8	28.8	144.0	28.8	28.8	28.8	28.8	28.8	3788.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1980	32.7	32.7	32.7	32.7	163.5	32.7	32.7	32.7	32.7	32.7	1340.6	32.7	32.7	32.7	32.7	32.7	32.7	32.7	163.5	32.7	32.7	32.7	32.7	32.7	4299.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1981	36.1	36.1	36.1	36.1	36.1	180.4	36.1	36.1	36.1	36.1	36.1	1478.9	36.1	36.1	36.1	36.1	36.1	36.1	36.1	180.4	36.1	36.1	36.1	36.1	36.1	4743.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1982	38.3	38.3	38.3	38.3	38.3	38.3	191.5	38.3	38.3	38.3	38.3	38.3	1570.0	38.3	38.3	38.3	38.3	38.3	38.3	38.3	191.5	38.3	38.3	38.3	38.3	38.3	5035.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1983	197.6	39.5	39.5	39.5	39.5	39.5	39.5	197.6	39.5	39.5	39.5	39.5	39.5	1620.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	197.6	39.5	39.5	39.5	39.5	39.5	5197.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1984	41.2	206.2	41.2	41.2	41.2	41.2	41.2	41.2	206.2	41.2	41.2	41.2	41.2	41.2	1690.4	41.2	41.2	41.2	41.2	41.2	41.2	41.2	206.2	41.2	41.2	41.2	41.2	41.2	5421.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1985	42.7	42.7	213.5	42.7	42.7	42.7	42.7	42.7	42.7	213.5	42.7	42.7	42.7	42.7	42.7	1750.6	42.7	42.7	42.7	42.7	42.7	42.7	42.7	213.5	42.7	42.7	42.7	42.7	42.7	5614.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986	5719.2	43.5	43.5	217.5	43.5	43.5	43.5	43.5	43.5	43.5	217.5	43.5	43.5	43.5	43.5	43.5	1783.2	43.5	43.5	43.5	43.5	43.5	43.5	43.5	217.5	43.5	43.5	43.5	43.5	43.5	5719.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1987	45.1	5927.9	45.1	45.1	225.4	45.1	45.1	45.1	45.1	45.1	45.1	225.4	45.1	45.1	45.1	45.1	45.1	1848.3	45.1	45.1	45.1	45.1	45.1	45.1	45.1	45.1	45.1	45.1	45.1	45.1	45.1	5927.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1988	46.9	46.9	6173.2	46.9	46.9	234.7	46.9	46.9	46.9	46.9	46.9	46.9	234.7	46.9	46.9	46.9	46.9	46.9	1924.7	46.9	46.9	46.9	46.9	46.9	46.9	46.9	46.9	234.7	46.9	46.9	46.9	46.9	6173.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1989	49.2	49.2	49.2	6470.6	49.2	49.2	246.0	49.2	49.2	49.2	49.2	49.2	49.2	246.0	49.2	49.2	49.2	49.2	49.2	2017.5	49.2	49.2	49.2	49.2	49.2	49.2	49.2	49.2	246.0	49.2	49.2	49.2	49.2	6470.6	0.0	0.0	0.0	0.0	0.0	0.0
1990	51.9	51.9	51.9	51.9	6820.3	51.9	51.9	259.3	51.9	51.9	51.9	51.9	51.9	51.9	259.3	51.9	51.9	51.9	51.9	51.9	2126.5	51.9	51.9	51.9	51.9	51.9	51.9	51.9	259.3	51.9	51.9	51.9	51.9	51.9	6820.3	0.0	0.0	0.0	0.0	0.0
1991	54.0	54.0	54.0	54.0	54.0	7107.3	54.0	54.0	270.2	54.0	54.0	54.0	54.0	54.0	54.0	270.2	54.0	54.0	54.0	54.0	54.0	2216.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	270.2	54.0	54.0	54.0	54.0	54.0	7107.3	0.0	0.0	0.0	0.0
1992	278.4	55.7	55.7	55.7	55.7	55.7	7321.2	55.7	55.7	278.4	55.7	55.7	55.7	55.7	55.7	55.7	278.4	55.7	55.7	55.7	55.7	55.7	2282.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	278.4	55.7	55.7	55.7	55.7	55.7	7321.2	0.0	0.0	0.0
1993	57.3	286.7	57.3	57.3	57.3	57.3	57.3	7540.4	57.3	57.3	286.7	57.3	57.3	57.3	57.3	57.3	57.3	286.7	57.3	57.3	57.3	57.3	57.3	2351.0	57.3	57.3	57.3	57.3	57.3	57.3	57.3	286.7	57.3	57.3	57.3	57.3	57.3	7540.4	0.0	0.0
1994	58.8	58.8	294.0	58.8	58.8	58.8	58.8	58.8	7733.5	58.8	58.8	294.0	58.8	58.8	58.8	58.8	58.8	58.8	294.0	58.8	58.8	58.8	58.8	58.8	2411.2	58.8	58.8	58.8	58.8	58.8	58.8	58.8	294.0	58.8	58.8	58.8	58.8	58.8	7733.5	0.0
1995	60.5	60.5	60.5	302.4	60.5	60.5	60.5	60.5	60.5	7952.6	60.5	60.5	302.4	60.5	60.5	60.5	60.5	60.5	60.5	302.4	60.5	60.5	60.5	60.5	60.5	2479.5	60.5	60.5	60.5	60.5	60.5	60.5	302.4	60.5	60.5	60.5	60.5	60.5	60.5	7952.6
1996	62.3	62.3	62.3	62.3	311.3	62.3	62.3	62.3	62.3	62.3	8187.4	62.3	62.3	311.3	62.3	62.3	62.3	62.3	62.3	62.3	311.3	62.3	62.3	62.3	62.3	62.3	62.3	2552.7	62.3	62.3	62.3	62.3	62.3	62.3	311.3	62.3	62.3	62.3	62.3	62.3
1997	63.7	63.7	63.7	63.7	63.7	318.5	63.7	63.7	63.7	63.7	63.7	8375.3	63.7	63.7	318.5	63.7	63.7	63.7	63.7	63.7	63.7	318.5	63.7	63.7	63.7	63.7	63.7	63.7	2611.3	63.7	63.7	63.7	63.7	63.7	63.7	318.5	63.7	63.7	63.7	63.7
1998	64.7	64.7	64.7	64.7	64.7	64.7	323.4	64.7	64.7	64.7	64.7	64.7	8505.8	64.7	64.7	323.4	64.7	64.7	64.7	64.7	64.7	64.7	323.4	64.7	64.7	64.7	64.7	64.7	64.7	2652.0	64.7	64.7	64.7	64.7	64.7	64.7	323.4	64.7	64.7	64.7
1999	66.1	66.1	66.1	66.1	66.1	66.1	66.1	330.6	66.1	66.1	66.1	66.1	66.1	8693.6	66.1	66.1	330.6	66.1	66.1	66.1	66.1	66.1	66.1	330.6	66.1	66.1	66.1	66.1	66.1	2710.6	66.1	66.1	66.1	66.1	66.1	66.1	66.1	330.6	66.1	66.1
2000	2801.7	68.3	68.3	68.3	68.3	68.3	68.3	68.3	341.7	68.3	68.3	68.3	68.3	68.3	8985.8	68.3	68.3	341.7	68.3	68.3	68.3	68.3	68.3	68.3	341.7	68.3	68.3	68.3	68.3	68.3	2801.7	68.3	68.3	68.3	68.3	68.3	68.3	68.3	341.7	68.3
2001	70.3	2881.4	70.3	70.3	70.3	70.3	70.3	70.3	70.3	351.4	70.3	70.3	70.3	70.3	70.3	9241.5	70.3	70.3	351.4	70.3	70.3	70.3	70.3	70.3	70.3	70.3	351.4	70.3	70.3	70.3	70.3	70.3	2881.4	70.3	70.3	70.3	70.3	70.3	70.3	351.4
2002	71.4	71.4	2926.9	71.4	71.4	71.4	71.4	71.4	71.4	71.4	356.9	71.4	71.4	71.4	71.4	71.4	9387.6	71.4	71.4	356.9	71.4	71.4	71.4	71.4	71.4	71.4	71.4	356.9	71.4	71.4	71.4	71.4	71.4	2926.9	71.4	71.4	71.4	71.4	71.4	71.4
2003	73.0	73.0	73.0	2993.7	73.0	73.0	73.0	73.0	73.0	73.0	73.0	365.1	73.0	73.0	73.0	73.0	73.0	9601.6	73.0	73.0	365.1	73.0	73.0	73.0	73.0	73.0	73.0	365.1	73.0	73.0	73.0	73.0	73.0	2993.7	73.0	73.0	73.0	73.0	73.0	73.0
2004	75.0	75.0	75.0	75.0	3073.4	75.0	75.0	75.0	75.0	75.0	75.0	75.0	374.8	75.0	75.0	75.0	75.0	75.0	9857.3	75.0	75.0	374.8	75.0	75.0	75.0	75.0	75.0	75.0	374.8	75.0	75.0	75.0	75.0	75.0	3073.4	75.0	75.0	75.0	75.0	75.0
2005	77.5	77.5	77.5	77.5	77.5	3177.5	77.5	77.5	77.5	77.5	77.5	77.5	77.5	387.5	77.5	77.5	77.5	77.5	77.5	10191.3	77.5	77.5	387.5	77.5	77.5	77.5	77.5	77.5	77.5	387.5	77.5	77.5	77.5	77.5	77.5	3177.5	77.5	77.5	77.5	77.5
2006	400.0	80.0	80.0	80.0	80.0	80.0	3280.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	400.0	80.0	80.0	80.0	80.0	80.0	10520.0	80.0	80.0	400.0	80.0	80.0	80.0	80.0	80.0	400.0	80.0	80.0	80.0	80.0	80.0	80.0	3280.0	80.0	80.0	80.0
2007	82.3	411.4	82.3	82.3	82.3	82.3	82.3	3373.4	82.3	82.3	82.3	82.3	82.3	82.3	82.3	411.4	82.3	82.3	82.3	82.3	82.3	10819.6	82.3	82.3	411.4	82.3	82.3	82.3	82.3	82.3	82.3	411.4	82.3	82.3	82.3	82.3	82.3	3373.4	82.3	82.3
2008	85.4	85.4	427.2	85.4	85.4	85.4	85.4	85.4	3502.9	85.4	85.4	85.4	85.4	85.4	85.4	85.4	427.2	85.4	85.4	85.4	85.4	85.4	11235.1	85.4	85.4	427.2	85.4	85.4	85.4	85.4	85.4	85.4	427.2	85.4	85.4	85.4	85.4	85.4	3502.9	85.4

Total Cost Per Year for Interstate Const. & Maint. in Nominal Dollars (Std. Maint)

Year	TOTAL COST	MAINT COST	CAPITAL COST	Federal	States
1956	$764,753,905	$5,815,619	$758,938,286	$683,044,457	$81,709,448
1957	$3,279,881,621	$30,904,425	$3,248,977,196	$2,924,079,477	$355,802,144
1958	$2,738,628,796	$52,368,635	$2,686,260,161	$2,417,634,145	$320,994,651
1959	$2,930,918,512	$74,618,405	$2,856,300,107	$2,570,670,096	$360,248,415
1960	$2,852,479,175	$97,015,175	$2,755,464,000	$2,479,917,600	$372,561,575
1961	$2,994,617,296	$120,025,956	$2,874,591,339	$2,587,132,205	$407,485,090
1962	$3,360,974,778	$171,498,849	$3,189,475,929	$2,870,528,336	$490,446,442
1963	$3,800,271,071	$282,997,786	$3,517,273,286	$3,165,545,957	$634,725,114
1964	$4,250,095,079	$295,458,294	$3,954,636,786	$3,559,173,107	$690,921,972
1965	$3,865,611,250	$332,323,750	$3,533,287,500	$3,179,958,750	$685,652,500
1966	$4,209,877,286	$366,242,143	$3,843,635,143	$3,459,271,629	$750,605,657
1967	$4,156,305,940	$409,380,619	$3,746,925,321	$3,372,232,789	$784,073,151
1968	$4,000,086,690	$463,741,762	$3,536,344,929	$3,182,710,436	$817,376,255
1969	$4,393,912,597	$529,173,222	$3,864,739,375	$3,478,265,438	$915,647,160
1970	$4,764,737,770	$935,641,984	$3,829,095,786	$3,446,186,207	$1,318,551,563
1971	$5,098,827,054	$2,069,665,714	$3,029,161,339	$2,726,245,205	$2,372,581,848
1972	$4,919,840,095	$1,877,218,095	$3,042,622,000	$2,738,359,800	$2,181,480,295
1973	$4,528,637,905	$2,074,840,190	$2,453,797,714	$2,208,417,943	$2,320,219,962
1974	$4,300,531,927	$2,227,211,623	$2,073,320,304	$1,865,988,273	$2,434,543,653
1975	$5,629,793,187	$2,510,786,222	$3,119,006,964	$2,807,106,268	$2,822,686,919
1976	$5,204,318,986	$2,875,615,361	$2,328,703,625	$2,095,833,263	$3,108,485,724
1977	$5,645,554,917	$3,371,918,667	$2,273,636,250	$2,046,272,625	$3,599,282,292
1978	$5,550,395,794	$3,843,948,794	$1,706,447,000	$1,535,802,300	$4,014,593,494
1979	$5,293,634,762	$3,920,613,190	$1,373,021,571	$1,235,719,414	$4,057,915,348
1980	$6,610,199,937	$4,582,453,651	$2,027,746,286	$1,824,971,657	$4,785,228,279
1981	$6,738,453,071	$4,942,139,214	$1,796,313,857	$1,616,682,471	$5,121,770,600
1982	$6,097,103,591	$4,920,734,127	$1,176,369,464	$1,058,732,518	$5,038,371,073
1983	$5,888,182,048	$5,299,154,762	$589,027,286	$530,124,557	$5,358,057,490
1984	$7,474,359,849	$5,614,846,706	$1,859,513,143	$1,673,561,829	$5,800,798,021
1985	$5,770,564,516	$4,884,036,587	$886,527,929	$797,875,136	$4,972,689,380
1986	$9,013,321,333	$4,973,347,905	$4,039,973,429	$3,635,976,086	$5,377,345,248
1987	$18,793,715,778	$4,496,608,063	$14,297,107,714	$12,867,396,943	$5,926,318,835
1988	$16,041,280,486	$4,155,742,861	$11,885,537,625	$10,696,983,863	$5,344,296,624
1989	$19,954,960,794	$5,008,443,651	$14,946,517,143	$13,451,865,429	$6,503,095,365
1990	$17,473,858,702	$4,659,937,345	$12,813,921,357	$11,532,529,221	$5,941,329,481
1991	$18,179,127,452	$4,629,902,810	$13,549,224,643	$12,194,302,179	$5,984,825,274
1992	$19,844,624,935	$4,334,885,845	$15,509,739,089	$13,958,765,180	$5,885,859,754
1993	$21,472,358,819	$4,491,105,873	$16,981,252,946	$15,283,127,652	$6,189,231,168
1994	$23,624,744,310	$4,660,701,810	$18,964,042,500	$17,067,638,250	$6,557,106,060
1995	$21,899,580,643	$4,686,027,857	$17,213,552,786	$15,492,197,507	$6,407,383,136
1996	$22,901,005,702	$4,287,846,631	$18,613,159,071	$16,751,843,164	$6,149,162,538
1997	$22,040,652,946	$4,035,218,393	$18,005,434,554	$16,204,891,098	$5,835,761,848
1998	$21,139,913,075	$4,575,998,611	$16,563,914,464	$14,907,523,018	$6,232,390,058
1999	$21,716,181,083	$4,172,159,833	$17,544,021,250	$15,789,619,125	$5,926,561,958
2000	$22,809,895,583	$5,815,815,833	$16,994,079,750	$15,294,671,775	$7,515,223,808
2001	$23,878,719,792	$10,632,683,417	$13,246,036,375	$11,921,432,738	$11,957,287,054
2002	$22,573,273,750	$9,478,352,750	$13,094,921,000	$11,785,428,900	$10,787,844,850
2003	$20,827,098,730	$10,658,207,302	$10,168,891,429	$9,152,002,286	$11,675,096,444
2004	$17,572,238,847	$9,628,015,615	$7,944,223,232	$7,149,800,909	$10,422,437,938
2005	$21,259,075,375	$9,936,732,250	$11,322,343,125	$10,190,108,813	$11,068,966,563
2006	$19,282,948,000	$11,032,216,000	$8,250,732,000	$7,425,658,800	$11,857,289,200
2007	$20,018,569,783	$12,239,357,121	$7,779,212,663	$7,001,291,396	$13,017,278,387
2008	$18,820,882,620	$13,185,864,853	$5,635,017,768	$5,071,515,991	$13,749,366,630

Total Cost Per Year for Interstate Const. & Maint. in Nominal Dollars (Dfd. Maint)

TOTAL COST	MAINT COST	CAPITAL COST
$758,938,286	$0	$758,938,286
$3,248,977,196	$0	$3,248,977,196
$2,692,439,256	$6,179,095	$2,686,260,161
$2,882,082,476	$25,782,369	$2,856,300,107
$2,801,862,000	$46,398,000	$2,755,464,000
$3,009,437,966	$134,846,627	$2,874,591,339
$3,323,816,794	$134,340,865	$3,189,475,929
$3,653,674,000	$136,400,714	$3,517,273,286
$4,098,122,500	$143,485,714	$3,954,636,786
$3,973,636,250	$440,348,750	$3,533,287,500
$5,175,383,143	$1,331,748,000	$3,843,635,143
$4,904,182,306	$1,157,256,984	$3,746,925,321
$4,837,344,310	$1,300,999,381	$3,536,344,929
$5,158,692,538	$1,293,953,163	$3,864,739,375
$5,279,173,421	$1,450,077,635	$3,829,095,786
$4,792,939,554	$1,763,778,214	$3,029,161,339
$4,933,567,746	$1,890,945,746	$3,042,622,000
$4,643,806,571	$2,190,008,857	$2,453,797,714
$5,668,041,542	$2,219,145,595	$3,448,895,946
$11,817,880,929	$2,478,412,286	$9,339,468,643
$10,130,433,099	$2,512,864,313	$7,617,568,786
$10,740,519,155	$2,518,711,548	$8,221,807,607
$10,586,798,254	$2,810,883,254	$7,775,915,000
$11,518,492,726	$3,165,694,190	$8,352,798,536
$13,701,812,063	$2,971,654,635	$10,730,157,429
$15,410,973,179	$3,166,288,679	$12,244,684,500
$16,236,530,913	$2,749,759,841	$13,486,771,071
$15,122,173,143	$3,361,227,286	$11,760,945,857
$20,964,063,798	$6,778,819,440	$14,185,244,357
$18,583,497,794	$5,626,036,794	$12,957,461,000
$18,014,506,206	$5,895,153,492	$12,119,352,714
$18,458,744,540	$5,333,501,968	$13,125,242,571
$18,064,449,903	$5,500,123,778	$12,564,326,125
$18,831,621,667	$6,781,810,952	$12,049,810,714
$17,208,096,849	$7,047,385,492	$10,160,711,357
$15,555,999,226	$7,573,876,619	$7,982,122,607
$17,369,240,214	$6,861,822,464	$10,507,417,750
$33,189,726,200	$7,733,187,004	$25,456,539,196
$27,070,747,167	$7,171,933,167	$19,898,814,000
$27,751,671,095	$6,955,874,667	$20,795,796,429
$26,111,821,000	$7,399,534,750	$18,712,286,250
$25,959,222,232	$7,493,324,643	$18,465,897,589
$28,383,144,722	$7,157,226,508	$21,225,918,214
$28,584,295,833	$6,142,442,833	$22,441,853,000
$29,253,664,000	$5,187,115,000	$24,066,549,000
$27,260,757,028	$6,348,472,778	$20,912,284,250
$36,508,955,972	$11,947,594,472	$24,561,361,500
$31,979,148,889	$9,821,408,889	$22,157,740,000
$31,148,369,407	$10,260,178,460	$20,888,190,946
$31,770,927,375	$9,206,139,750	$22,564,787,625
$30,858,292,000	$9,446,896,000	$21,411,396,000
$31,516,909,634	$11,368,265,657	$20,148,643,977
$28,355,772,482	$11,617,963,474	$16,737,809,008

APPORTIONMENT OF FEDERAL FUNDS ADMINISTERED BY THE FEDERAL HIGHWAY ADMINISTRATION (1950-1996)

APRIL 1997

(THOUSANDS OF DOLLARS)

TABLE FA-204

YEAR	National Highway System	Interstate Construction	Interstate Maintenance	Interstate Substitution	CONSOLI-DATED PRIMARY 4/	RURAL SECOND-ARY	URBAN SYSTEM	ABC PRIMARY	ABC SECOND-ARY	ABC URBAN	FOREST HIGHWAY AND PUBLIC LANDS FUNDS 5/	SURFACE TRANSPOR-TATION PROGRAM	EQUITY ADJUST-MENTS 6/	HIGHWAY SAFETY	HAZARD ELIMI-NATION 7/	ELIMINATION OF HAZARDS AT RAIL-HIGHWAY CROSSINGS 8/	BRIDGE PROGRAM 9/	METRO-POLITAN PLANNING	CONGESTION MITIGATION AND AIR QUALITY IMPROVE-MENT	OTHER 10/	TOTAL
1950	0	0	0	0	0	0	0	202,500	135,000	112,500	20,000	0	0	0	0	0	0	0	0	0	470,000
1951	0	0	0	0	0	0	0	202,500	135,000	112,500	23,500	0	0	0	0	0	0	0	0	0	473,500
1952	0	0	0	0	0	0	0	225,000	150,000	125,000	23,500	0	0	0	0	0	0	0	0	0	523,500
1953	0	0	0	0	0	0	0	225,000	150,000	125,000	20,000	0	0	0	0	0	0	0	0	0	520,000
1954	0	25,000	0	0	0	0	0	247,500	165,000	137,500	22,500	0	0	0	0	0	0	0	0	0	597,500
1955	0	25,000	0	0	0	0	0	247,500	165,000	137,500	22,500	0	0	0	0	0	0	0	0	0	597,500
1956	0	175,000	0	0	0	0	0	315,000	210,000	175,000	22,500	0	0	0	0	0	0	0	0	0	897,500
1957	0	175,000	0	0	0	0	0	315,000	210,000	175,000	22,500	0	0	0	0	0	0	0	0	0	897,500
1958	0	1,700,000	0	0	0	0	0	382,500	255,000	212,500	30,000	0	0	0	0	0	0	0	0	0	2,580,000
1959	0	2,200,000	0	0	0	0	0	393,750	262,500	218,750	35,000	0	0		0	0	0	0	0	400,000	3,510,000
1960	0	2,487,500	0	0	0	0	0	402,975	268,650	223,875	33,000	0	0	0	0	0	0	0	0	0	3,416,000
1961	0	1,782,000	0	0	0	0	0	379,861	259,717	224,783	35,950	0	0	0	0	0	0	0	0	0	2,682,311
1962	0	2,178,000	0	0	0	0	0	380,239	259,874	224,970	36,600	0	0	0	0	0	0	0	0	0	3,079,683
1963	0	2,370,000	0	0	0	0	0	411,047	274,031	228,359	35,780	0	0	0	0	0	0	0	0	0	3,319,217
1964	0	2,567,500	0	0	0	0	0	422,156	281,438	234,531	47,374	0	0	0	0	0	0	0	0	0	3,552,999
1965	0	2,652,750	0	0	0	0	0	431,072	287,381	239,484	41,900	0	0	0	0	0	0	0	0	0	3,652,587
1966	0	2,765,000	0	0	0	0	0	444,375	296,250	246,875	39,850	0	0	0	0	0	0	0	0	0	3,792,350
1967	0	2,955,000	0	0	0	0	0	443,250	295,500	246,250	39,815	0	0	0	0	0	0	0	0	0	3,979,815
1968	0	3,362,600	0	0	0	0	0	445,050	296,700	247,250	45,786	0	0	71,250	0	0	0	0	0	68,500	4,537,136
1969	0	3,752,500	0	0	0	0	0	444,375	296,250	246,875	33,000	0	0	71,250	0	0	0	0	0	0	4,844,250
1970	0	3,940,000	0	0	73,875	49,250	0	487,575	325,050	270,875	47,150	0	0	63,412	0	0	0	0	0	320,300	5,577,487
1971	0	3,920,000	0	0	73,500	49,000	0	485,100	323,400	269,500	48,430	0	0	0	0	0	0	0	0	296,000	5,464,930
1972	0	3,964,060	0	0	73,500	49,000	98,000	485,100	323,400	269,500	33,000	0	0	99,750	0	0	0	0	0	198,000	5,593,310
1973	0	3,964,060	0	0	73,500	49,000	98,000	485,100	323,400	269,500	33,000	0	0	125,000	0	0	0	0	0	98,000	5,518,560
1974	0	2,543,543	0	0	1,047,483	376,220	752,441	0	0	0	33,000	0	0	117,600	0	0	0	23,462	0	0	4,893,749
1975	0	2,965,113	0	0	1,181,955	389,845	769,695	0	0	0	33,000	0	0	151,900	147,000	73,471	0	26,447	0	171,990	5,910,416
1976	0	3,235,515	0	0	1,362,042	434,100	771,734	0	0	0	33,000	0	0	175,861	145,500	63,913	122,209	27,388	0	457,910	6,829,172
1977	0	3,112,484		0	1,263,026	389,045	778,090	0	0	0	33,000	0	0	145,021	122,187	195,499	175,950	28,103	0	356,790	6,599,195
1978	0	3,263,980	170,204	0	1,263,025	389,043	778,083	0	0	0	33,001	0	0	149,577	122,185	195,492	175,951	29,201	0	406,828	6,976,570
1979	0	3,280,245	170,207	0	1,385,010	486,857	779,690	0	0	0	32,010	0	0	195,020	122,500	186,200	628,000	30,732	0	308,700	7,605,171
1980	0	3,261,036	170,424	0	1,532,669	536,307	780,077	0	0	0	32,010	0	0	193,275	147,000	186,200	878,000	32,956	0	308,700	8,058,654
1981	0	3,519,979	170,643	0	1,630,180	585,060	780,080	0	0	0	32,010	0	0	240,792	147,000	186,200	928,174	34,178	0	308,700	8,562,996
1982	0	3,519,979	268,153	0	1,337,650	390,040	780,080	0	0	0	32,010	0	0	106,764	196,000	186,200	682,000	32,343	0	49,000	7,580,219
1983	0	3,162,527	780,080	0	1,803,179	633,815	780,080	0	0	0	6,840	0	515,492	105,769	196,000	186,200	1,368,000	45,325	0	10,471	9,593,778
1984	0	3,599,254	1,901,445	259,875	2,102,576	640,283	788,040	0	0	0	0	0	424,033	104,375	198,000	188,100	1,428,500	49,252	0	0	11,683,733
1985	0	3,640,200	2,758,140	779,625	2,305,380	640,283	788,040	0	0	0	0	0	959,949	117,758	198,000	188,100	1,532,500	52,223	0	0	13,960,198
1986	0	3,483,671	2,930,524	515,165	2,380,213	612,750	754,154	0	0	0	0	0	618,475	117,322	189,486	180,012	1,714,000	52,300	0	0	13,548,072
1987	0	2,623,950	2,541,292	543,900	2,300,392	584,115	730,511	0	0	0	0	0	725,258	125,335	166,600	156,800	1,372,400	46,620	0	0	11,917,173
1988	0	2,771,526	2,543,599	543,900	2,300,697	584,659	730,438	0	0	0	0	0	803,891	125,494	166,600	156,550	1,372,400	47,356	0	0	12,147,110
1989	0	2,421,526	2,543,599	543,900	2,301,831	584,657	730,438	0	0	0	0	0	1,215,943	128,403	166,600	156,550	1,372,400	47,356	0	0	12,213,203
1990	0	2,733,413	2,508,620	536,421	2,281,896	576,618	720,393	0	0	0	0	0	1,182,013	123,989	164,309	154,397	1,353,527	46,705	0	0	12,382,301
1991	0	2,754,287	2,528,201	540,848	2,288,873	581,376	726,338	0	0	0	0	0	1,134,984	125,690	165,665	155,670	1,363,435	47,091	0	0	12,412,459
1992	2,835,387	1,630,500	2,339,336	233,400	0	0	0	0	0	0		3,283,101	2,223,801	136,989	0	0	2,136,394	116,681	826,061	0	15,761,650
1993	3,389,937	1,218,685	2,795,955	232,800	0	0	0	0	0	0		3,925,486	2,264,754	156,859	0	0	2,569,765	139,661	987,188	0	17,681,090
1994	3,372,134	1,061,282	2,782,497	231,600	0	0	0	0	0	0		3,905,213	2,527,025	156,859	0	0	2,556,844	138,950	982,100	0	17,714,504
1995	3,343,992	1,329,620	2,775,290	230,999	0	0	0	0	0	0	0	3,869,451	2,826,708	182,186	0	0	2,549,113	138,588	975,104	0	18,221,051
1996	2,937,204	0	2,427,203	0	0	0	0	0	0	0		3,406,415	1,729,862	151,925	0	0	2,221,702	138,077	857,530	1,933,249	15,803,166

1/ Excludes allocated funds.

2/ "Interstate" prior to 1992. Also includes "Lapsed Interstate" in 1976, 1978, and 1979.

3/ "Interstate 4R" from 1987 to 1991, "Interstate Resurfacing," prior to 1987.

4/ "Rural Primary" 1970-1976. Includes "Priority Primary" and "Urban Extensions Primary and Secondary," from 1974-1976.

5/ "Public Lands" included 1961-1968 and 1970-1971.

6/ "From 1992-1996, includes "Donor State Bonus," "Apportionment Adjustment," and "Ninety Percent Minimum Allocation Funds." "Eighty-five Percent Minimum Allocation" prior to 1992.

7/ "Elimination of Roadside Obstacles" prior to 1981. Also includes "High Hazard Locations" in 1975 and 1976.

8/ "Rail-Highway Crossings" prior to 1977.

9/ "Bridge Replacement and Rehabilitation" from 1982-1991; "Bridge Replacement" prior to 1982.

10/ Includes "Interstate Reimbursement" in 1996; "P.L. 104-59 Restoration Funds" in 1996; "Economic Growth Center Funds" from 1976-1983; "Pavement Marking Demonstration Funds" from 1977-1981"; "Off-System Safer Roads Funds" from 1977-1979; "Special Urban High Density Traffic Program Funds" from 1977-1978; "Pavement Marking" from 1975-1976; "Safer Roads Demonstration Program" from 1975-1976; "Off System Roads" in 1976; "Topics" from 1970 to 1973; "Right-of-way Revolving" from 1970-1972; "Highway Beautification" in 1968 and 1970; and supplemental Federal-aid Highway Act of 1958 apportionment in 1959;

11/ The transition quarter includes the months of July, August, and September 1976.