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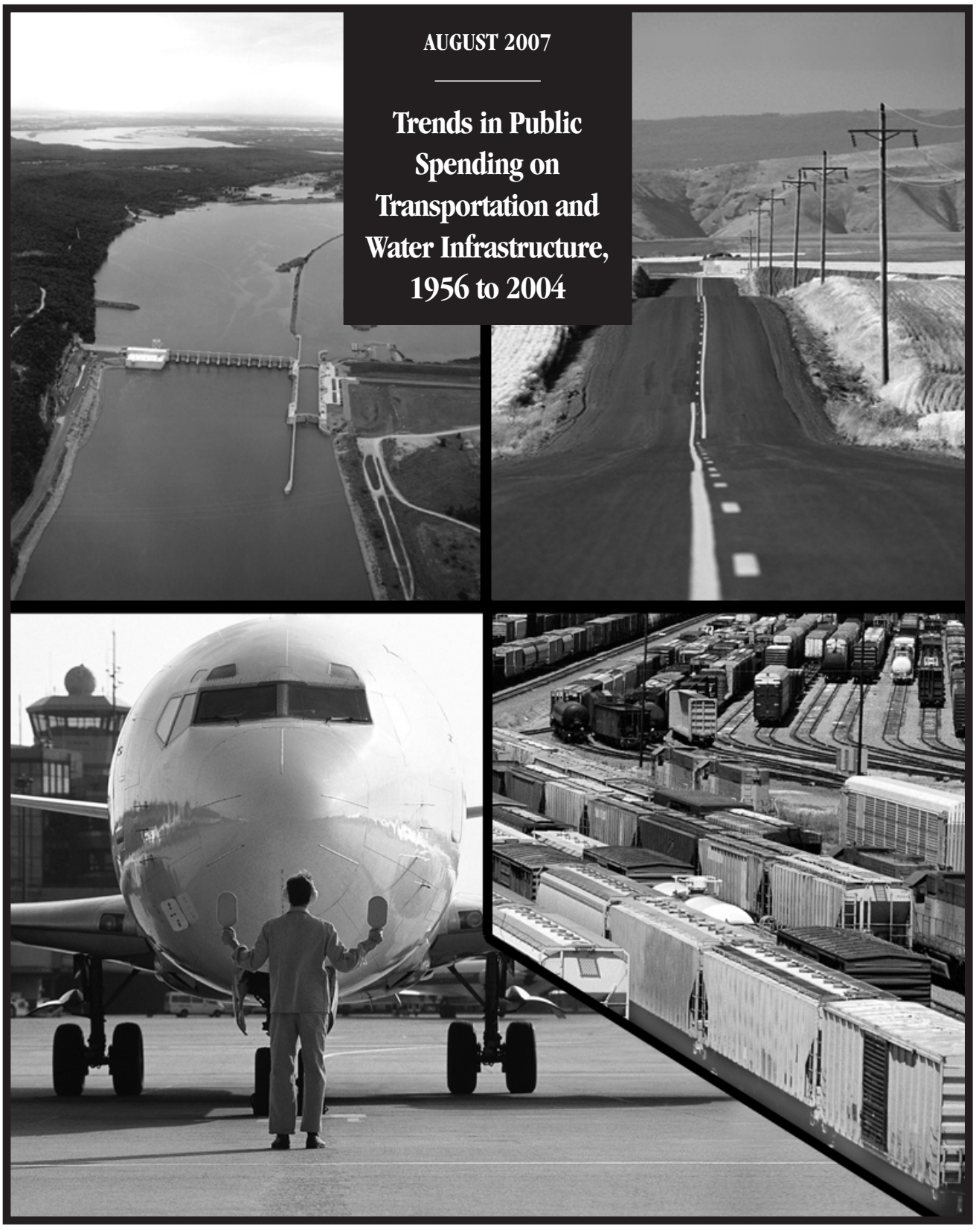

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Trends in Public Spending on Transportation and Water Infrastructure, 1956 to 2004

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The Congress of the United States ■ Congressional Budget Office

Notes

Unless stated otherwise, spending by state and local governments is net of federal grants and loan subsidies.

All years cited in the paper refer to fiscal years.

Numbers in the text and tables may not add up to totals because of rounding.

Dollar values that have been adjusted for inflation are expressed in 2006 dollars.

Among the photographs on the cover, the top left-hand one shows Webbers Falls Lock and Dam, located near Webbers Falls, Oklahoma, on the Arkansas River; it is used courtesy of the Department of Energy. Clockwise from that, the photographs are © S. Alden/ Photolink/Photodisc/Getty Images; TR002563/Photodisc/Getty Images; and JupiterImages.

Preface

The nation's infrastructure plays a vital role in its economy. Vigorous commerce and the daily activities of the nation require reliable means of transporting merchandise from producers to consumers and of conveying passengers to their destinations. Fundamental to economic activity as well is sound stewardship of the nation's resources, including ensuring an adequate supply of fresh water and of wastewater treatment services.

In response to a June 2007 request from the Chairman and Ranking Member of the Senate Finance Committee, this paper by the Congressional Budget Office (CBO) analyzes spending on infrastructure by the federal government and state and local governments. It updates and expands upon the agency's May 1999 *Trends in Public Infrastructure Spending*. In accordance with CBO's mandate to provide objective and impartial analysis, the paper contains no recommendations.

Nathan Musick of CBO's Microeconomic Studies Division wrote the paper under the supervision of Joseph Kile and David Moore. Elizabeth Robinson and Lawrence Hush of the Office of Management and Budget and Henry Wulf and Stephen Owens of the Bureau of the Census provided the primary data on infrastructure spending and supplied helpful answers to questions about them. Carma Ray Hogue of the Bureau of the Census, Nicole Carter and Robert Kirk of the Congressional Research Service, Paul Aussendorf of the Government Accountability Office, Thomas Holtmann of the Joint Committee on Taxation, and David Joulfaian and Thornton Matheson of the Department of Treasury provided additional insights into the data on infrastructure spending and tax expenditures. Within CBO, Robert Dennis, Scott Dennis, Ann Futrell, Mark Hadley, Arlene Holen, Jeff Holland, Daniel Hoople, Majorie Miller, Donald Marron, Sarah Puro, Bob Sunshine, Tom Woodward, and Dennis Zimmerman provided useful comments. Bill Reinhardt of *Public Works Financing* reviewed the draft. (The assistance of an external reviewer implies no responsibility for the final product, which rests solely with CBO.)

John Skeen edited the manuscript, and Kate Kelly proofread it. Maureen Costantino designed the cover and prepared the paper for publication. Lenny Skutnik produced the printed copies, and Linda Schimmel handled the distribution. Simone Thomas prepared the electronic version for CBO's Web site (www.cbo.gov).

Peter R. Orszag
Director

August 2007

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Trends in Public Spending on Transportation and Water Infrastructure, 1956 to 2004

Introduction and Summary

The nation's infrastructure plays a vital role in its economy and in the daily lives of its citizens. Since the mid-1950s, expenditures for transportation and water infrastructure by the federal government and state and local governments have annually accounted for over 2 percent of the nation's gross domestic product (GDP). In 2004, such spending for infrastructure was more than $312 billion (measured in 2006 dollars).

This Congressional Budget Office (CBO) paper describes the trends in public spending for transportation and water infrastructure since 1956.[1] CBO focuses on spending for highways and roads, mass transit, rail, aviation, water transportation, water resources such as the construction and maintenance of dams and levees, and water supply and wastewater treatment. Those types of infrastructure, which draw heavily on federal resources, share the economic characteristics of being relatively capital intensive and producing services under public management that facilitate private economic activity. They are typically the types examined by studies that attempt to calculate the payoff, in terms of benefits to the economy, from government funding of infrastructure.[2]

Broader definitions of infrastructure might include such things as energy generation and distribution facilities and telecommunications networks—or schools and research labs. Those types of infrastructure, however, are often primarily provided by either state and local governments or the private sector, and they are not included in this paper.

The paper reports public spending both for capital and for operation and maintenance. Capital spending is for the purchase, construction, rehabilitation, and improvement of physical infrastructure. Spending for operation and maintenance is composed of expenditures that are generally required to provide the services needed for infrastructure to function and that are often necessary for the repair and safe operation of existing infrastructure. (In some cases—as with air traffic control services, for instance—the costs can be sizable.)[3]

CBO's tally of public spending on infrastructure provides a budgetary perspective on such spending. As such, this paper reports gross governmental spending on infrastructure capital and related operation and maintenance. The budgetary perspective stands in contrast to an alternative economic perspective that would, in particular, focus on measuring the value of the stock of

1. This paper is the fifth in a series of reports by CBO on the topic since 1992. The last paper was Congressional Budget Office, *Trends in Public Infrastructure Spending* (May 1999).

2. See, for example, Edward M. Gramlich, "Infrastructure Investment: A Review Essay," *Journal of Economic Literature*, vol. 32, no. 3 (September 1994), pp. 1176–1196.

3. For accessibility, CBO has adopted the phrase operation and maintenance. Most of the expenditures for those purposes are classified by the Office of Management and Budget as being for "noninvestment activities"; the corresponding classification by the Bureau of the Census is "current operations." In addition to operation and maintenance per se, the category includes expenditures for related purposes—for instance, to cover administrative and other expenses of government infrastructure programs and to conduct public safety and educational programs and research and development related to infrastructure. A methodological appendix to this paper, which has been published as a Web supplement (available at www.cbo.gov), provides a comprehensive discussion of data sources and definitions.

Box 1.

Different Measures of Public Infrastructure

Public infrastructure is one type of capital that contributes to the U.S. economy's output and performance. The budgetary focus of this report is different from the perspective that would be necessary to measure the contribution of public spending on infrastructure to economic performance. Such an alternative perspective would differ by recognizing depreciation of the capital stock when reporting public spending for both infrastructure capital as well as for operation and maintenance.

For example, the annual spending on infrastructure capital that the Congressional Budget Office (CBO) reports can also be considered gross investment, because it includes spending both to replace depreciated capital (which results from wear and tear as infrastructure is used) and to add to the capital stock. By contrast, net investment in infrastructure—which reflects changes to the stock of capital available to supply infrastructure services—would be expressed net of depreciation. Even though there are many challenges in measuring stocks of publicly owned infrastructure and other capital, the Department of Commerce's Bureau of Economic Analysis does so for different levels of government in the national income and product accounts. Additionally, although CBO reports spending on operation and maintenance to provide infrastructure services, that figure does not include expenses incurred through the depreciation of the infrastructure that is part of the cost of providing those services.

infrastructure and changes in that value as investments are made and physical assets depreciate (see Box 1).

The data that CBO uses for its analysis of public spending on transportation and water infrastructure, which come from the Office of Management and Budget (OMB) and the Bureau of the Census, cover federal spending from 1956 to 2006 and state and local government spending from 1956 to 2004. The data on federal spending also incorporate CBO's estimate of spending for 2007 and its baseline projections through 2009 (the period through which expenditures on highways and roads and mass transit, which account for over one-half of federal spending on infrastructure, have been authorized by the Congress).[4] CBO reports total federal spending on infrastructure as well as its two components: (1) grants and loan subsidies to states and localities, which constitute almost two-thirds of the total, and (2) all other federal spending on infrastructure. CBO reports state and local spending net of the federal grants and loan subsidies.

4. The baseline projections for programs governed by annual appropriations assume that the appropriated amounts increase each year at the rate of inflation. The numbers in this paper reflect CBO's baseline projections that were issued in March 2007.

From 1956 to 2004, annual public spending on infrastructure, adjusted for inflation, rose steadily—growing an average of 2.3 percent per year. During the first several decades of the span, that growth was mostly attributable to increases in federal expenditures, particularly, rising capital spending on highways and roads, water supply and wastewater treatment facilities, and rail.

From 1987 onward, infrastructure spending by the federal government and by states and localities has grown in real terms by 1.7 percent and 2.1 percent, respectively. Additionally, several other key features of public infrastructure spending have been quite stable over roughly the past two decades:

- Infrastructure spending by states and localities has accounted for around three-fourths of total spending;
- Capital expenditures have been slightly less (about 45 percent) than expenditures for operation and maintenance (55 percent);
- As a share of GDP, infrastructure spending has fluctuated between 2.3 percent and 2.6 percent; and
- Federal spending on infrastructure has hovered around 3 percent of total expenditures in the federal budget.

In 2006, the federal government spent $76.3 billion on infrastructure. Grants and loan subsidies totaled $50.6 billion, and all other federal spending on infrastructure totaled $25.7 billion. Over and above those amounts (and the other federal spending on infrastructure reported throughout this paper) are revenues forgone through the tax preferences that the federal government offers on municipal bonds issued by states and localities to finance their infrastructure spending. In 2006, those forgone revenues amounted to an estimated $7.9 billion, or about 16 percent of the value of grants and loan subsidies provided by the federal government in that year.

Several recent developments have influenced the amount of federal resources allocated to infrastructure and related activities. First, the hurricanes of 2005 prompted increased federal spending both to repair damage to highways and roads and to respond to and recover from future hurricanes, flooding, and other natural disasters. Those expenditures totaled $3.3 billion in 2006.

Second, as a result of the heightened terrorist threat after September 11, 2001, federal spending to make public infrastructure more secure—especially the facilities and services for air travel—has been sizable. Because such expenditures are essentially for national defense and law enforcement, they are not included in the totals reported here. However, from 2002 to 2006, spending on airline and airport security by the Transportation Security Administration of the Department of Homeland Security amounted to $28.8 billion (financed in part by $8.7 billion in revenues from security and cargo fees). Those expenditures have paid for a variety of security measures, including hiring additional federal air marshals and conducting more-rigorous screening of passengers, baggage, and other cargo. From 2003 to 2006, the Department of Homeland Security also provided $1.4 billion in grants to states.

Third, another relatively new development is the growth in the private sector's interest in participating in infrastructure projects. According to the available data, such private activity has most likely accounted for only a very small share of spending on public infrastructure in the United States, but private funding and participation may increase in the future as the growing resources of pension funds that seek stable long-term investments are tapped by governments at various levels for upgrades to and expansion of infrastructure.

As part of its analysis of public spending on infrastructure, CBO has also reviewed the current literature on the resulting economic returns. Such spending provides benefits to the economy by reducing the cost of private business transactions or yielding other social benefits. During the past 20 years, economists have attempted to measure the purely economic benefits from public expenditures on infrastructure and have obtained a wide range of estimates. The literature supports two conclusions: first, that public spending on infrastructure often has positive economic returns and, second, that both the average return and the range of returns among projects vary significantly and depend upon a number of factors. For example, research suggests that the returns to early public investments, such as expanding the interstate highway system, can be large but that the economic payoff from such spending declines as those types of systems grow.

Basic Features of Public Spending on Infrastructure

Real (inflation-adjusted) public spending on infrastructure totaled just over $312 billion in 2004. Of that, the federal government spent $73.5 billion, about 24 percent of the total, on projects that it funded directly and on grants and loan subsidies to state and local governments. States and localities spent $238.7 billion, or 76 percent of the total. The spending shares of the federal government and states and localities have been quite stable over roughly the past two decades (see Table A-1 in the appendix).[5]

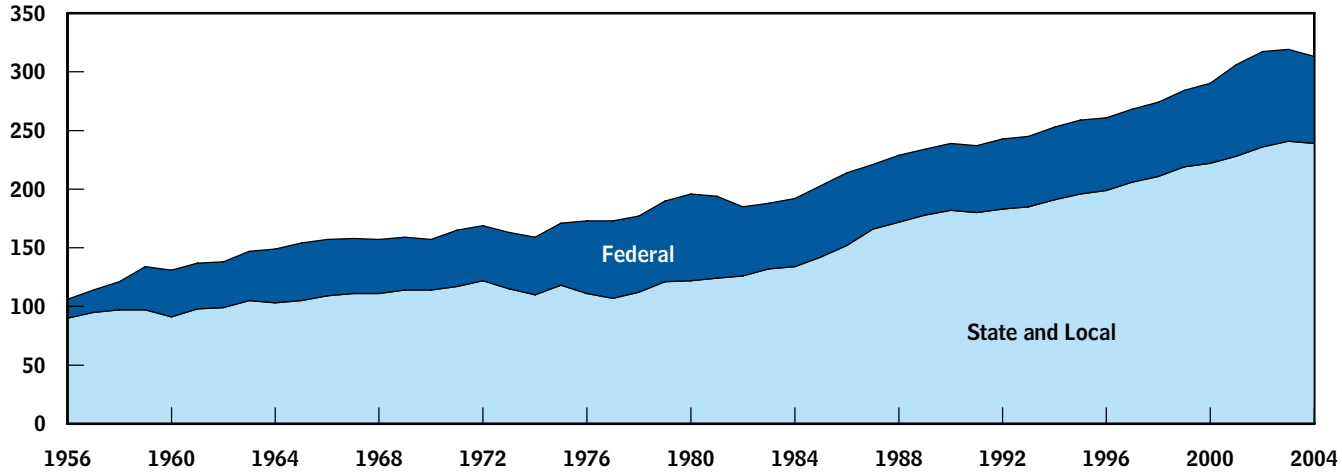
Between 1956 and 2004, annual spending on infrastructure rose steadily, growing an average of 2.3 percent each year (after an adjustment for inflation) (see Figure 1). At times, that overall growth masks highly divergent trends in spending at the federal and the state and local levels. From 1956 through the mid-1970s, real federal spending on infrastructure grew much more rapidly than did state and local spending; on average, federal spending grew at an annual rate of 7 percent, versus about 1 percent for state and local spending. In 1977, federal spending reached its peak share of 38 percent of total spending. From the late 1970s through the mid-1980s, real state and local spending grew at a faster

5. In addition to the tables in the appendix, the Web supplement to this paper provides greater detail on spending.

Figure 1.

Public Spending on Infrastructure, 1956 to 2004

(Billions of 2006 dollars)



Source: Congressional Budget Office.

Note: Data on state and local spending do not include expenditures on freight rail or, after 1990, water resources.

annual rate than did federal spending, which, on average, declined slightly. Between 1987 and 2004, spending by the federal government rose 1.7 percent annually, while yearly spending by state and local governments grew by 2.1 percent.[6]

Infrastructure Spending and the Federal Budget

Since the late 1980s, federal spending on infrastructure typically has constituted around 3 percent of all federal spending. As a share of nondefense spending, which is another useful basis of comparison because this paper primarily includes expenditures on civilian infrastructure, federal spending on infrastructure during that period has ranged between roughly 3.5 percent and 4 percent (see Table A-2).

Before the late 1980s, infrastructure spending as a share of nondefense federal expenditures was considerably greater than it is today, regularly accounting for about 10 percent or more from 1959 through 1966, which was part of a period of exceptionally rapid growth in federal spending on infrastructure. The subsequent decline of that share occurred in part because of a rise in spending on domestic programs unrelated to infrastructure—for example, health care and income support programs generally and Medicare and Social Security in particular.

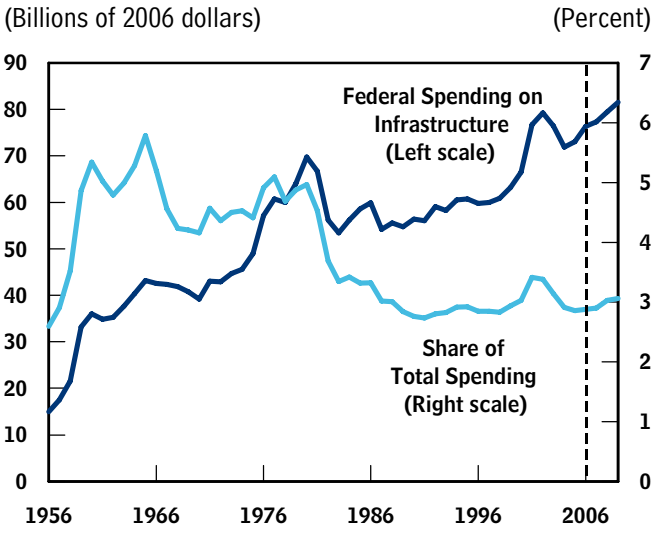
After adjusting for inflation, CBO estimates that federal spending on infrastructure will rise from $76.3 billion in 2006 to $77.3 billion in 2007; under CBO's assumptions for its baseline, outlays would rise further—to $79.4 billion in 2008 and $81.5 billion in 2009. Spending on infrastructure would account for roughly 3 percent of total federal spending during that period (see Figure 2).

6. The recent figures for state and local governments do not include spending on water resources, because specific data have been unavailable since 1991. The Bureau of the Census's most relevant category (Other Natural Resources—Function Code 59) includes spending on both water resource infrastructure and other activities, such as environmental projects (for example, soil conservation, reclamation, and erosion-control measures), regulation of mineral and energy resources, and geological surveying and mapping. Annual expenditures in that category are approximately $12 billion.

   Figures on state and local governments' spending on freight rail are also not included here, because the Bureau of the Census does not collect data on it (the agency puts expenditures for passenger rail in the mass transit category). However, recent data on states' spending on both freight and passenger rail together can be found in Virginia Department of Rail and Public Transportation, *State Rail Agencies Throughout the U.S.—Structure, Governance, Funding* (October 2005), available at http://freight.transportation.org/doc/rail/DRPT_railreport.pdf.

Figure 2.

Federal Spending on Infrastructure in Dollars and as a Share of Total Federal Spending, 1956 to 2009



Source: Congressional Budget Office.

Note: The dashed vertical line separates actual from projected spending. The 2007 amount is the Congressional Budget Office's estimate of outlays in that year. The 2008 and 2009 amounts are the agency's baseline projections of outlays in those years.

Public Spending on Infrastructure as a Share of Gross Domestic Product

As a share of GDP, public spending on infrastructure has ranged from 2.3 percent to 2.5 percent since the mid-1980s. Before then, it had trended downward, from a peak of 3 percent in the late 1950s and early 1960s. Spending shares for capital and for operation and maintenance have similarly been fairly stable over the past two decades (see Table A-3).

Although infrastructure spending as a share of GDP serves as a measure of the importance of public infrastructure in the economy, for several reasons it does not necessarily indicate whether the appropriate level of investment in infrastructure is taking place. First, although infrastructure spending facilitates the growth of the economy and improvement in the quality of life, determining the level of infrastructure spending that is appropriate for those purposes is difficult. Similarly, determining the level of spending necessary for the efficient and safe operation of existing infrastructure is difficult at the aggregate level, because individual infrastructure projects have varying needs depending upon their age, type of construction, intensity of use, and other factors.

Second, economic growth and the additional demands it may place on infrastructure need not always give rise to proportionate increases in infrastructure spending. The average cost of providing some services, for example, highway or rail transportation, could decline as use increased. That outcome is likely whenever high fixed costs (that is, costs that do not vary regardless of the number of users) are incurred when the infrastructure is first put in place and additional users can be accommodated with little or no additional cost. Conversely, because infrastructure facilities usually are subject to wear over time, simply reporting annual investment does not provide insight into whether the spending is sufficient to remedy deterioration and accommodate potential new demands from economic growth.[7]

Finally, public spending on infrastructure as a share of GDP may not maintain a predictable relationship to economic activity because such spending may be intended to achieve policy goals apart from facilitating commerce, such as providing widespread access to basic services. For example, federal expenditures for water supply and wastewater treatment are often made to support such infrastructure in disadvantaged communities.[8]

Infrastructure Spending for Capital and for Operation and Maintenance

In 2004, public spending on infrastructure for capital projects totaled $143.6 billion, and spending for opera-

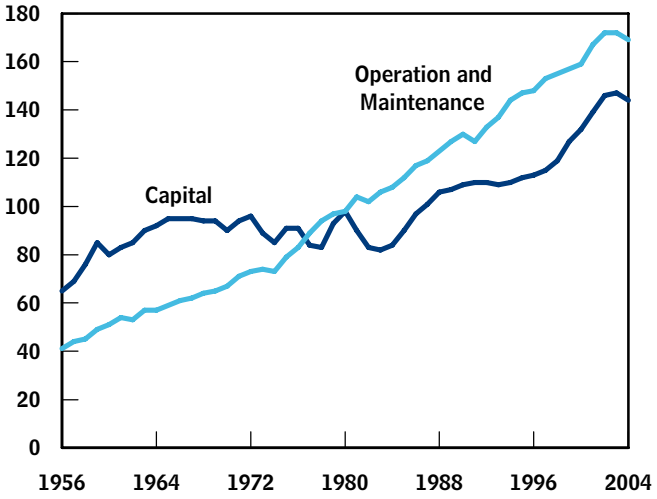
7. Stocks of infrastructure capital, which incorporate both new investment as well as assumptions about how quickly the existing infrastructure capital depreciates, are calculated by both the Office of Management and Budget (see *Budget of the United States, Fiscal Year 2008: Analytical Perspectives*, pp. 63–65) and the Department of Commerce's Bureau of Economic Analysis (available at www.bea.gov/bea/dn/FA2004/SelectTable.asp#S7).

8. The Rural Utilities Service of the Department of Agriculture and the Community Development Block Grants program of the Department of Housing and Urban Development fund such projects in disadvantaged communities; such funding is also available through the Environmental Protection Agency's Drinking Water State Revolving Fund. See Environmental Protection Agency, *Handbook on Coordinating Funding for Water and Wastewater Infrastructure—A Compilation of State Approaches* (October 2003), pp. 1–2).

Figure 3.

Public Spending for Infrastructure Capital and Related Operation and Maintenance, 1956 to 2004

(Billions of 2006 dollars)



Source: Congressional Budget Office.

Note: Data on state and local spending do not include expenditures on freight rail or, after 1990, water resources.

tion and maintenance amounted to $168.7 billion. The shares of capital expenditures and operation and maintenance expenditures within the total have been fairly stable at around 45 percent and 55 percent, respectively, since the early 1980s. Before then, capital expenditures usually exceeded spending on operation and maintenance (see Figure 3 and Table A-4). Since 1981, real growth in spending on capital has averaged 2.0 percent a year; for operation and maintenance, it has averaged 2.1 percent.

As a share of GDP, capital spending has remained relatively flat; it was 1.09 percent in 1983 and 1.10 percent in 2004. The increase in public capital spending between 1983 and 2004 in real terms—from $81.9 billion to $143.6 billion—was due primarily to the growth of capital spending by states and localities, which now account for more capital spending on infrastructure than does the federal government, as they did prior to the mid-1970s (even with federal grants and loan subsidies excluded from states' and localities' spending) (see Box 2 on page 9).[9] Adjusted for inflation, annual capital expenditures by states and localities rose from $41 billion in 1983 to $87.2 billion in 2004.[10] From the late 1990s through about 2003, federal capital expenditures also rose rapidly, in part as a result of several transportation measures enacted by the Congress and the President (including the Transportation Equity Act for the 21st Century, Public Law 105-178, 112 Stat. 107 (1998), and the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century, P.L. 106-181, 114 Stat. 61 (2000)).[11] Nevertheless, state and local governments currently account for about 60 percent of total public capital spending.

Total spending for operation and maintenance has been a fairly constant share of GDP over the past three decades. During that period, the federal government has allocated somewhat over one-fourth of its infrastructure spending to operation and maintenance, whereas the corresponding proportion for state and local governments has risen steadily, from 41 percent in 1956 to 63 percent in 2004 (see Figures 4 and 5 and Tables A-5 and A-6). State and local governments account for the vast majority—close to 90 percent—of spending on operation and maintenance.

Economic Returns to Public Spending on Infrastructure

Federal spending on infrastructure increases the stock of publicly owned capital and, in that sense, is an investment in the future productivity of the private sector. The economic literature on the topic today supports two con-

9. OMB notes, however, that some federal grants and loan subsidies classified as capital spending are not always ultimately disbursed as such because the state or local government ultimately determines how the money is used. See *Budget of the United States Government, Fiscal Year 2008: Analytical Perspectives*, p. 55. Additionally, because OMB classifies federal outlays according to how most of the money is expected to be spent, some portion of a grant or loan that is classified as capital spending may be used by a state or locality for some other purpose.

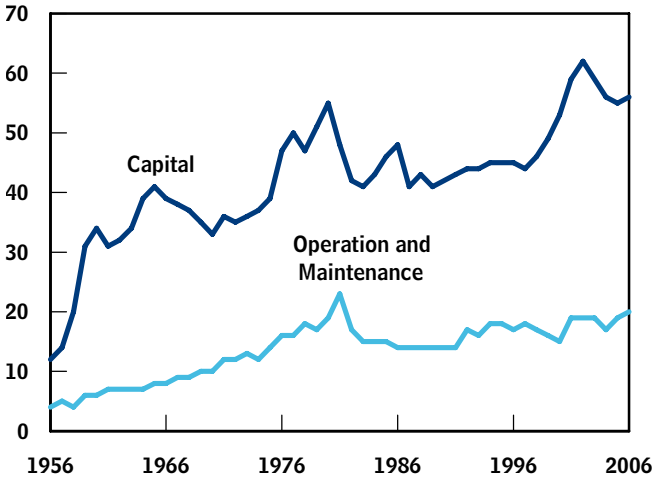
10. A comparison of federal and state and local spending on infrastructure on the basis of outlays does not, however, recognize the financial burden that the federal government incurs by making exempt from most taxes the income from bonds issued by state and local governments to finance infrastructure. Debt financing is especially appropriate to capital projects, which often require substantial up-front investment but which generate revenues only over time. The cost to the federal government from tax-exempt bond financing is considered below.

11. Those spending programs have since been reauthorized in, respectively, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, P.L. 109-59, 119 Stat. 1144 (2005), and Vision 100—Century of Aviation Reauthorization Act, P.L. 108-176, 117 Stat. 2490 (2003).

Figure 4.

Federal Spending for Infrastructure Capital and Related Operation and Maintenance, 1956 to 2006

(Billions of 2006 dollars)



Source: Congressional Budget Office.

clusions: first, that public spending on infrastructure often displays positive economic returns and, second, that both the average return and the range of returns among projects will probably vary significantly and depend upon a number of factors. The early research on the economic payoff from public spending on infrastructure found very large returns. For example, one prominent study from the late 1980s found that a 1 percent increase in the stock of "core infrastructure" (consisting basically of the types of infrastructure included in this paper, plus electrical and natural gas facilities) was associated with a 0.24 percent increase in the level of national output from 1949 to 1985.[12] That result suggested that public capital enhanced the economy's ability to produce goods and services so much that $1 spent on infrastructure could generate close to $1 of output within roughly a year. An implication of such findings was that a substantial part of the productivity slump of the 1970s and 1980s was due to a shortfall of investment in infrastructure.

But estimates of such large returns have proved controversial. For example, some of those estimates have been found to be very sensitive to minor changes in the data that generated them—such as changing slightly the time period or sectors of the economy covered by the analysis. Follow-on research has identified other methodological weaknesses and, after attempting to correct for them, has in some cases come to a different conclusion about the economic returns to public spending on infrastructure. For example, the size of the stock of public capital and the level of economic output can vary together over time for reasons unrelated to a causal link between them. One study that has attempted to control for that spurious covariance finds that, as a result, the estimated positive association of public capital with economic performance disappears.[13] Further, the direction of causality may not be certain: For example, additions to public capital may not be what is making states more productive; it may be that more productive and prosperous states spend more on infrastructure. One study finds that, once such state-specific characteristics are recognized, public capital plays no role in the differences among states' economic performance.[14]

Recent surveys that include a number of countries in addition to the United States find a positive economic payoff from investment in public capital. For example, a 2007 study concludes that the recent literature reflects more consensus about the "growth-enhancing effect of

12. Most of the issues considered in the 1990s were raised by David Alan Aschauer, "Is Public Expenditure Productive?" *Journal of Monetary Economics*, vol. 23, no. 2 (March 1989), pp. 177–200, and discussed in a large number of papers reviewed by Alicia H. Munnell, "Policy Watch: Infrastructure Investment and Economic Growth," *Journal of Economic Perspectives*, vol. 6, no. 4 (Autumn 1992), pp. 189–198, and Edward M. Gramlich, "Infrastructure Investment: A Review Essay," *Journal of Economic Literature*, vol. 32, no. 3 (September 1994), pp. 1176–1196. See also Congressional Budget Office, *The Economic Effects of Federal Spending on Infrastructure and Other Investments* (June 1998). A more recent examination is Jeffrey P. Cohen and Catherine J. Morrison Paul, "Public Infrastructure Investment, Interstate Spatial Spillovers, and Manufacturing Costs," *Review of Economics and Statistics*, vol. 86, no. 2 (May 2004), pp. 551–559. The precise definition of public capital and the periods covered by those papers vary.

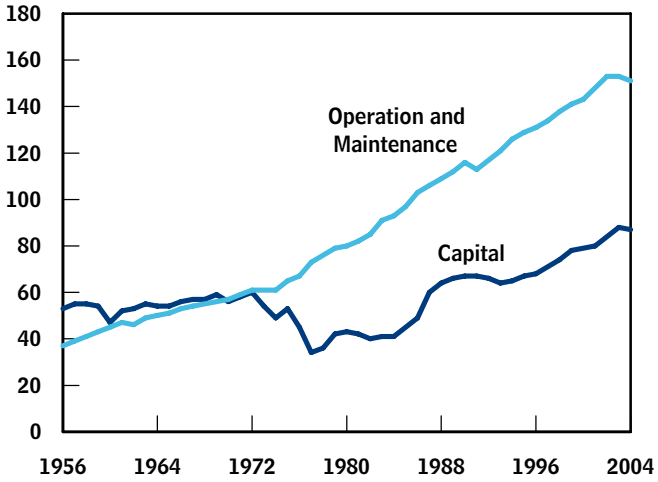
13. See Charles R. Hulten and Robert M. Schwab, "Public Capital Formation and the Growth Process in Developing Countries," *National Tax Journal*, vol. 44, no. 1, part 1 (December 1991), pp. 121–134. A criticism of such efforts that focus on year-to-year changes is that they can mask any long-term relationship between accumulated stocks of public capital and subsequent economic performance—when additions to the stock of public capital could influence economic activity for a number of years after they occur.

14. See Douglas Holtz-Eakin, "Public-Sector Capital and the Productivity Puzzle," *Review of Economics and Statistics*, vol. 76, no. 1 (February 1994), pp. 12–21.

Figure 5.

State and Local Spending for Infrastructure Capital and Related Operation and Maintenance, 1956 to 2004

(Billions of 2006 dollars)



Source: Congressional Budget Office.

Note: Data on state and local spending do not include expenditures on freight rail or, after 1990, water resources.

public capital" than existed before. Similarly, a study sponsored by the Organization for Economic Cooperation and Development finds a "positive effect of infrastructure."[15] The implications of those findings for public spending on infrastructure in the United States, though, are unclear because much of the newer research supporting those favorable assessments took place under circumstances that may not be relevant in this country. Those studies range from analyses of national and regional spending on infrastructure within various countries in Europe, South America, and Asia to investigations of economic returns to infrastructure spending in a large sample of countries at different levels of development.

Moreover, some important results cited by those surveys rely on a concept of infrastructure that is broad, including public investment in basic telecommunications, for example, and other areas that in the United States are funded by private rather than public investment.[16]

Altogether, recent research finds that the returns to investment in public capital in the United States are positive, but below earlier estimates. For example, a 2006 study concludes that public spending on highways and roads from 1982 to 1996 reduced annual congestion costs to drivers by $0.11 for every dollar spent.[17] However, because the measure of spending in that study combines expenditures for capital and operation and maintenance, the amount by which public spending during any particular year reduces congestion costs in subsequent years would be considerably less than the average annual estimate of $0.11—as expenditures for operation and maintenance typically continue on an annual basis.

Consistent with such findings, other economic research points out that the payoff from investments in public infrastructure such as highways falls off significantly after the initial impact that those investments had on economic activity. For example, according to data spanning 1953 to 1989, construction of the interstate highway system in the United States made vehicle-intensive industries in particular more productive; however, the capital spending that took place after completion of that system in 1973 effectively had no impact on differences in

15. For a comprehensive overview of the relevant economic literature, with brief descriptions of individual papers and their results, see Ward Romp and Jakob de Haan, "Public Capital and Economic Growth: A Critical Survey," *Perspektiven der Wirtschaftspolitik*, vol. 8, special issue no. 1 (April 2007), pp. 6–52. See also Vincent Ribeyrol, "Impact of Infrastructure on the Economy: Review of the Literature" (paper presented at the Organization of Economic Cooperation and Development's conference entitled Global Infrastructure Needs: Prospects and Implications for Public and Private Actors, Paris, June 3, 2005).

16. See Lars-Hendrik Röller and Leonard Waverman, "Telecommunications Infrastructure and Economic Development: A Simultaneous Approach," *American Economic Review*, vol. 91, no. 4 (September 2001), pp. 909–923, and Christophe Hurlin, "La Contribution du Capital Public à la Productivité des Facteurs Privés: une Estimation sur Panel Sectoriel pour Dix Pays de l'OCDE (May 1999), available at www.dauphine.fr/eurisco/CH_Recherche/Panel.pdf. The latter study applies two definitions of infrastructure: one that includes only equipment used in the provision of public services and the other that includes investment undertaken in conjunction with all types of activities provided by government (ranging from telecommunications to national defense).

17. Congestion costs basically reflect both the amount of gasoline consumed as well as the value of the time that motorists lose as a result of traffic delays. See Clifford Winston and Ashley Langer, "The Effect of Government Highway Spending on Road Users' Congestion Costs," *Journal of Urban Economics*, vol. 60, no. 3 (November 2006), pp. 463–483.

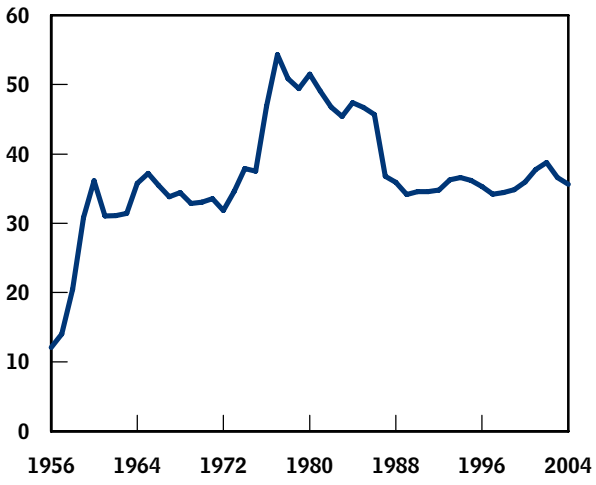
Box 2.

Federal Grants and Loan Subsidies to States and Localities for Infrastructure

Federal grants and loan subsidies account for a significant share of capital expenditures by states and localities. (In this paper, federal grants and loan subsidies are included in the category of federal spending.) Amounting to $50.6 billion in 2006, such grants and loans also represent a large portion—almost two-thirds—of total federal spending on infrastructure. Most indirect federal outlays are intended for capital purchases. Since the late-1980s, such outlays have accounted for a bit over one-third of state and local governments' total capital expenditures on infrastructure (see the figure). From the late 1970s through the mid-1980s, that share was substantially higher, reflecting a temporary increase in the federal government's portion of expenditures at the state and local levels for highways and roads and for water supply and wastewater treatment systems. Currently, almost all indirect federal outlays for infrastructure consist of grants and loan subsidies for highways and roads, mass transit, aviation, and water supply and wastewater treatment. The importance that such outlays have for states and localities varies among the types of infrastructure: In 2004, the capital portion of federal grants and loan subsidies accounted for almost one-half of total state and local capital expenditures for highways and mass transit and about one-third and one-tenth, respectively, of such expenditures for aviation and for water supply and wastewater treatment.

Federal Grants and Loan Subsidies as a Share of State and Local Governments' Capital Spending for Infrastructure, 1956 to 2004

(Percent)



Source: Congressional Budget Office.

industries' productivity.[18] The evidence thus suggests positive returns to investments in infrastructure, but those returns depend on the type of infrastructure and the amount of infrastructure already in place.

Infrastructure Spending by Type of Project

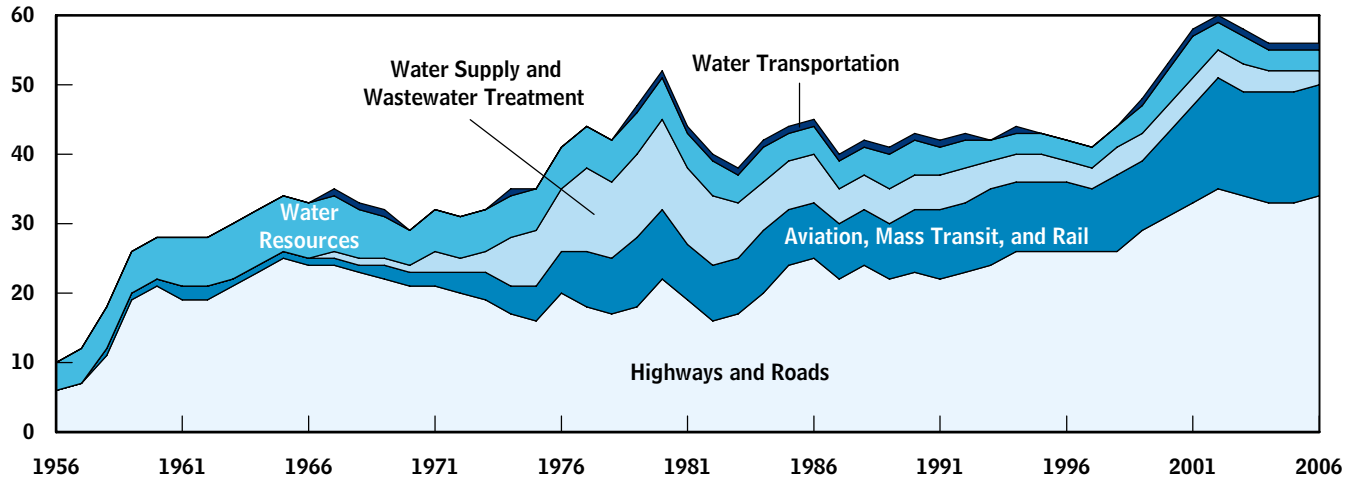
Priorities for infrastructure programs have changed more at the federal level than at the state and local levels. Although the largest part of federal spending for infrastructure has been for highways and roads, the shares devoted to water supply and wastewater treatment and to mass transit and rail significantly increased during the 1970s. Beginning in the mid-1980s and continuing to the present, highways and roads once again and, to lesser degrees, aviation followed by mass transit and water resources have been the primary sectors for federal

18. See John G. Fernald, "Roads to Prosperity? Assessing the Link Between Public Capital and Prosperity," *American Economic Review*, vol. 89, no. 3 (June 1999), pp. 619–638.

Figure 6.

Federal Capital Spending for Infrastructure, by Type, 1956 to 2006

(Billions of 2006 dollars)



Source: Congressional Budget Office.

dollars. (Some of those highway and water resource projects undertaken in the past several years were in response to damage from the hurricanes in 2005.)

In contrast to federal spending, the priorities for state and local spending have changed little since the 1970s: Expenditures for highways and roads have always been predominant. However, expenditures at the state and local levels are distributed somewhat more evenly among the various types of infrastructure—in particular, highways and roads, aviation, and mass transit and rail—than they are at the federal level.

The Composition of Federal Spending on Infrastructure

Capital spending, much of which is for highway and road projects, accounts for about three-fourths of all infrastructure expenditures by the federal government. Over 80 percent of that capital spending is typically done through grant and loan subsidy programs for states and localities. In contrast, only around 10 percent of spending for operation and maintenance is done through grants and loan subsidies.

Capital. By far, the largest amount of federal capital spending is for highways and roads. In 2006, approximately $34 billion in capital expenditures, or 60 percent of the total, went for highway and road projects (see Figure 6).[19] Mass transit accounted for $8.4 billion, followed by aviation ($6.2 billion), water resources ($3.4 billion), and water supply and wastewater treatment ($2.2 billion). Water transportation projects and rail accounted for about $1 billion each.[20]

Almost all of the capital spending on highways and roads, mass transit, and water supply and wastewater treatment was done through grant and loan programs. Federal capital expenditures on aviation took the form of both grants (through the Airport Improvement Program) and direct outlays for the facilities and equipment account of the Federal Aviation Administration. Capital spending on the remaining types of infrastructure consisted of direct outlays by the Bureau of Reclamation and the Army Corps of Engineers for water resource projects, by the Coast Guard for water transportation, and by the Federal Railroad Administration for rail.

Although highways and roads have always dominated federal capital spending, that share has fluctuated

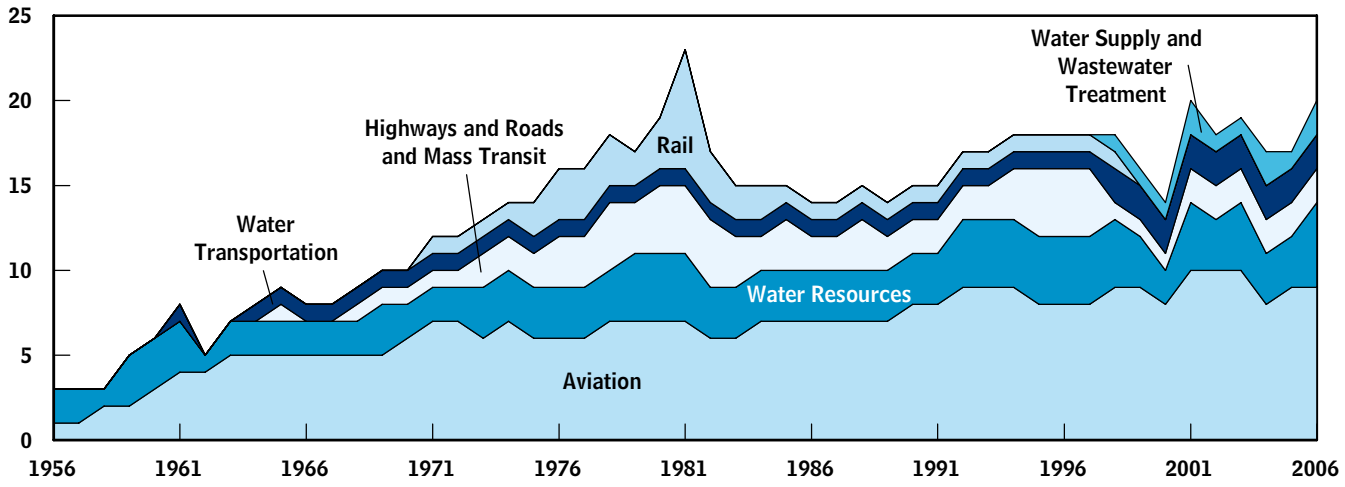
19. Included in that total are expenditures of about $849 million through the Emergency Relief Program of the Federal Highway Administration to repair damage caused by Hurricane Katrina to highways and roads.

20. Most of those federal capital outlays correspond quite closely to the spending totals reported in *Budget of the United States Government, Fiscal Year 2008: Analytical Perspectives*, Table 6-2, "Federal Investment Budget Authority and Outlays: Grant and Direct Federal Programs," p. 58.

Figure 7.

Federal Spending on the Operation and Maintenance of Infrastructure, by Type, 1956 to 2006

(Billions of 2006 dollars)



Source: Congressional Budget Office.

between roughly 40 percent and 70 percent. In particular, highway and road expenditures accounted for a substantially smaller share (48 percent) of all federal capital spending from 1971 through 1980 than they did before that time. In contrast, in the 1971–1980 period, water supply and wastewater treatment accounted for 21 percent and aviation, mass transit, and rail, 15 percent of total federal spending on infrastructure capital; the corresponding spending shares on those types of infrastructure prior to that time were 2 percent and 4 percent, respectively.[21] The shifting emphasis of federal spending on infrastructure has reflected some particular priorities at different times: establishing and improving highways and roads in the 1950s and facilities for providing clean water in the 1970s.

Operation and Maintenance. In 2006, spending on aviation operation and maintenance by the Federal Aviation Administration to run the nation's air traffic control system amounted to $8.9 billion, representing 45 percent of total federal spending for infrastructure operation and maintenance (see Figure 7). Such spending on water resources—which for the most part funded the activities of the Corps of Engineers and the Bureau of Reclamation—was $5.4 billion (or 27 percent of the total), while $2.1 billion (or 11 percent) went to the Coast Guard for its role in supporting water transportation. Water supply and wastewater treatment accounted for $1.8 billion and highways, $1.2 billion.

During the past several years, operation and maintenance spending for water resources has spiked as a result of expenditures from the Flood Control and Coastal Emergencies account of the Corps of Engineers. From $150 million in 2005, those outlays increased to $2.5 billion in 2006. Those expenditures are intended to improve the Corps of Engineers' ability to address future flooding, hurricanes, and other natural disasters.

The federal government has also devoted substantial resources in the wake of the terrorist attacks of September 11, 2001, to making public infrastructure more secure. However, because those expenditures are made primarily for purposes of national defense and law enforcement, they are excluded from public spending on infrastructure as defined in this paper (but considered separately in Box 3). Within the federal programs whose infrastructure expenditures are reported by this paper,

21. The boost in spending on infrastructure capital for water supply and wastewater treatment was the result of the Clean Water Act of 1972, which required (and made federal money available for) greater efforts to clean wastewater before it could be discharged to surface waters. See Congressional Budget Office, *Future Investment in Drinking Water and Wastewater Infrastructure* (November 2002), p. 6.

Box 3.

Federal Spending to Protect Critical Infrastructure

Federal funding of homeland security related to infrastructure—though not included in this paper—has been sizable.[1] The largest sum of federal spending specifically intended to protect public infrastructure against terrorist attack has been by the Transportation Security Administration (currently part of the Department of Homeland Security) to increase aviation security. Totaling $28.8 billion in nominal dollars from 2002 through 2006 (and financed in part by $8.7 billion in revenues from security and air cargo fees), those expenditures have paid for a variety of security measures, including hiring additional federal air marshals and conducting more-rigorous screening of passengers, baggage, and other cargo. Of that amount, spending for aviation security operations was $24.8 billion (or 86 percent of the total); outlays for security equipment accounted for the remainder. Those outlays for aviation security operations are equal to 58 percent of the federal spending for aviation operation and maintenance during the 2002–2006 period (for the air traffic control system and other purposes).[2] Spending to make the nation's water transportation system more secure has also been concentrated on aviation—which has been around 50 percent of total spending for those purposes—followed by spending on water resources and, from the 1970s through the 1990s, highways and mass transit. Additionally, from the mid-1970s to late 1980s, rail spending claimed a sizable share of federal resources for infrastructure, peaking in 1981 as a result of the settlement of litigation related to the government's acquisition of the assets of Conrail.[23]

1. With its focus on public infrastructure, this paper does not include federal funding of programs specifically intended to make infrastructure more secure, nor projects that mainly serve military or police functions. Thus, the federal funding of the Army Corps of Engineers reported here applies only to civil works, and the expenditures reported for the Coast Guard do not reflect its drug interdiction, migrant interdiction, or other law enforcement.

2. From 2001 through 2005, airlines also received $4.6 billion from the federal government in compensation for losses they incurred through the ground stop ordered for civil aviation after the terrorist attacks of September 11, 2001, and for other (incremental) losses that the airlines incurred through the end of that year. This paper has not included those outlays as infrastructure spending.

spending to protect infrastructure (and thus related to homeland security) typically accounted for less than 5 percent of the total funds available from 2003 to 2006. Hence, spending for homeland security by federal infrastructure programs does not represent a large reallocation of public resources for infrastructure as defined by this paper and earlier ones by CBO.[22]

With only a few exceptions since 1956, federal spending for the operation and maintenance of infrastructure has

22. See *Budget of the United States Government: Fiscal Years 2005–2008: Analytical Perspectives, Homeland Security Mission Funding by Agency and Budget Account.* CBO's calculations of funding shares are in terms of budget authority (basically the amount of money that federal programs are approved to spend each year). However, those shares are not exhaustive of federal agencies' spending to protect the infrastructure for which they are responsible, because agencies may also allocate funds to efforts related to homeland security in ways that cannot be linked to specific infrastructure programs (see, for example, the discussion by Mary Tiemann, *Safeguarding the Nation's Drinking Water: EPA and Congressional Actions,* CRS Report for Congress RL31294 (Congressional Research Service, January 25, 2006).

23. The Regional Rail Reorganization Act of 1973 (known as the 3R Act) established the Consolidated Rail Corporation (Conrail) to assume the assets, routes, and service of the Penn Central and other bankrupt railroads in the Northeast. The 3R Act set the stage for Amtrak to take over the rights of way, tracks, and facilities between Boston and Washington, D.C.—that is, the Northeast Corridor. That takeover was subsequently accomplished through passage of the Railroad Revitalization and Regulatory Reform Act of 1976 (the 4R Act). In 1981, the federal government reached a settlement with Penn Central and its subsidiaries and affiliates on the value of properties transferred to Conrail in 1976. That settlement amounted to $2.1 billion in principal and interest (about $4.6 billion in 2006 dollars). Smaller settlements were also reached with other litigants over the next several years.

Box 3.

Continued

The Department of Homeland Security's Grants to Protect Critical Infrastructure

	Grants Through 2006		Grants Expected in 2007	
	Amount	Percent	Amount	Percent
Transit Security Grant Program	$388	28.2	$172	43.4
Intercity Passenger Rail Program	$13	1.0	Included above	Included above
Trucking Security Program	$50	3.6	$12	2.9
Port Security Grant Program	$874	63.6	$201	50.8
Intercity Bus Security Program	$49	3.5	$12	2.9
	$1,374	100.0	$396	100.0

Source: Congressional Budget Office based on Department of Homeland Security, "DHS Announces Close to $400 Million in Grants Available to Secure the Nation's Critical Infrastructure" (press release, July 6, 2006), "DHS Awrds $399 Million in Grants to Secure the Nation's Critical Infrastructure" (press release, September 25, 2006), and "DHS Announces $445 Million to Secure Critical Infrastructure" (press release, January 9, 2007).

been substantial. Obligations (that is, binding agreements that will result in expenditures) by the Coast Guard's Ports, Waterways and Costal Security program have exceeded $1 billion annually since that program's inception in 2003 and totaled almost $5 billion over the 2003–2006 period.[3]

The Department of Homeland Security has also made grants to both governments at the state and local levels and private entities to protect critical infrastructure. Currently administered by the Office of Grants and Training, those grants have been available for various types of surface transportation as well as for ports (which have received the bulk of the funds). Through 2006, such grants amounted to $1.4 billion, with another $400 million expected in 2007 (see the table).[4]

3. See *Budget of the United States Government, Fiscal Years 2005–2008, Appendix for the Department of Homeland Security.*

4. Data on homeland security spending by states and localities are not available. As part of its State and Local Finance statistics program, the Bureau of the Census does, however, collect data on state and local governments' expenditures on several categories of public safety: police protection, fire protection, correction (facilities), and protective inspection and regulation. See Steven Maguire and Shawn Reese, *Department of Homeland Security Grants to State and Local Governments: 2003 to 2006*, CRS Report for Congress RL33770 (Congressional Research Service, January 19, 2007), pp. 15–20.

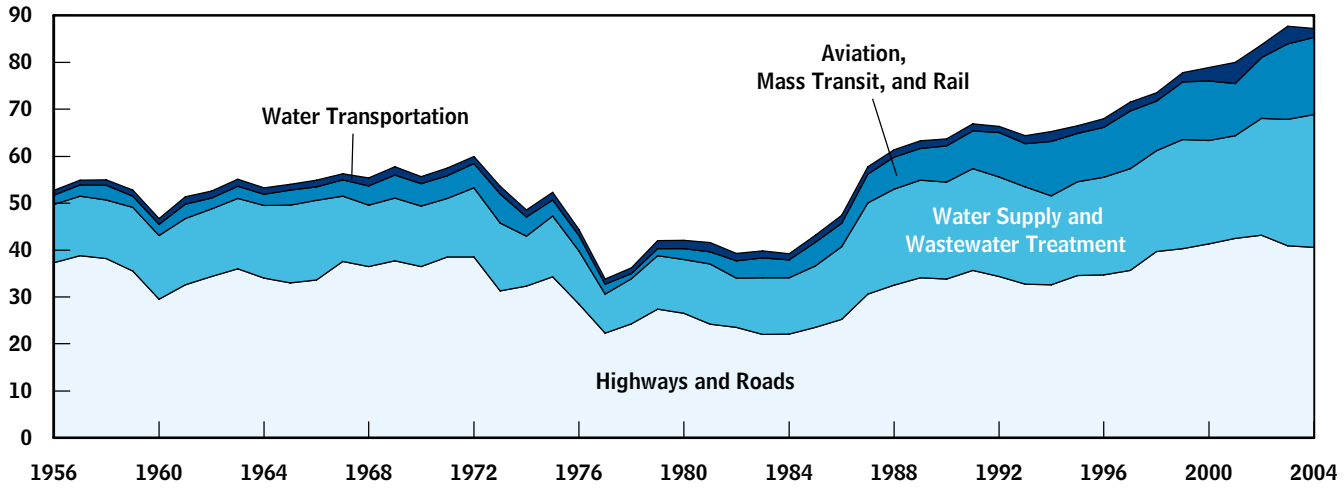
The Composition of State and Local Spending on Infrastructure

State and local expenditures on infrastructure differ from spending at the federal level in several ways. First, expenditures for operation and maintenance account for about two-thirds of the total for states and localities but typically slightly more than one-fourth for the federal government. Second, spending on highways and roads constitutes the largest share of both operation and maintenance as well as capital expenditures by states and localities, while federal spending for the operation and maintenance of highways and roads is small relative to such federal spending on other types of infrastructure. Third, infrastructure spending by states and localities for either capital or operation and maintenance is less concentrated on a particular type of infrastructure than is federal spending. Finally, states and localities' priorities for both capital and operation and maintenance expenditures have remained fairly stable.

Figure 8.

State and Local Capital Spending for Infrastructure, by Type, 1956 to 2004

(Billions of 2006 dollars)



Source: Congressional Budget Office.

Note: State and local spending does not include expenditures on freight rail.

Capital. In 2004, state and local spending (after an adjustment for inflation) on highways and roads totaled $40.6 billion and accounted for 47 percent of total capital expenditures by those levels of government. States and localities also spent $28.3 billion (32 percent) on water supply and wastewater treatment, $8.9 billion (10 percent) on mass transit (which includes passenger rail), $7.5 billion (9 percent) on aviation, and $1.9 billion (2 percent) on water transportation. The increases in real capital spending at the state and local levels since 1983 represent a marked departure from the trend prior to that time, when that spending was either stable or declining depending on the type of infrastructure (see Figure 8). Such growth has been especially pronounced for aviation, mass transit, and rail and for water supply and wastewater treatment—the latter probably because of states' and localities' need (as federal funding declined) to meet requirements of the Clean Water Act of 1972.

Operation and Maintenance. In 2004, states and localities' spending for the operation and maintenance of highways and roads was $58.5 billion, or 39 percent of their total spending for operation and maintenance. (Such state and local spending accounted for 98 percent of total public spending for the operation and maintenance of highways and roads.) Spending by states and localities on water supply and wastewater treatment was $51.2 billion (34 percent of their spending on operation and maintenance); on mass transit (including passenger rail), $29.9 billion (20 percent); on aviation, $9.3 billion (6 percent); and on water transportation, $2.5 billion (2 percent). Operation and maintenance spending at the state and local levels has persistently increased since the mid-1950s (see Figure 9).

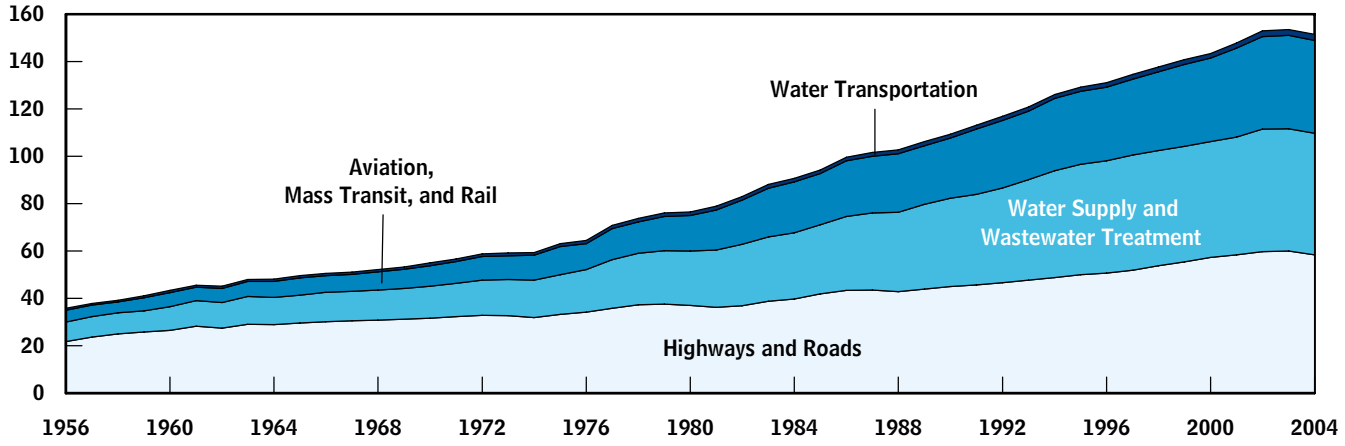
Tax-Exempt Bond Financing and the Private Sector's Role in Supplying Public Infrastructure

In addition to making grants and subsidized loans for infrastructure spending by states and localities, the federal government also provides a source of funding to those levels of government through the tax revenues it forgoes by offering tax exemptions on debt they issue—estimated at $7.9 billion in 2006, or 16 percent of the $50.6 billion in federal grants and loan subsidies that year. The proceeds from tax-exempt bonds can, in certain cases, be used to fund private-sector activities (which is also true for funds available through some federal grant and loan programs). According to the available data, such privatization for public infrastructure has been modest. However, recent developments suggest a potentially larger role for the private sector in providing public infrastructure.

Figure 9.

State and Local Spending on the Operation and Maintenance of Infrastructure, by Type, 1956 to 2004

(Billions of 2006 dollars)



Source: Congressional Budget Office.

Note: State and local spending does not include expenditures on freight rail.

Tax-Exempt Bond Financing

Tax-exempt bonds issued by states and localities can be of two types: general governmental obligations and private activity bonds that are used by a nongovernmental entity to finance certain types of projects. The tax exemption for governmental obligations is greater than for private activity bonds, because interest income from private activity bonds is subject to the alternative minimum tax. According to data from the Internal Revenue Service, governmental obligations account for most (approximately 87 percent) of the tax-exempt debt that has been issued to finance public infrastructure since the early 1990s. (That share applies both to funding for new projects and refinancing of debt on existing projects.) On an annual basis, the amount of governmental obligations and private activity bonds issued by state and local governments to finance infrastructure projects has fluctuated markedly (see Figure 10).[24]

Although a small amount of private activity bonds has been issued relative to governmental obligations, they tend to be concentrated on only a few types of infrastructure projects, and, as a result, they make an important contribution to covering the capital costs. In particular, about 80 percent of the total value of private activity bonds issued between 1991 and 2004 to finance infrastructure projects, as defined by this paper, funded airport construction, according to data from the Internal Revenue Service. Some studies suggest that, for that purpose, private activity bonds may have been as important over the past decade as other types of funding such as federal grants or airport user charges.[25] In addition to

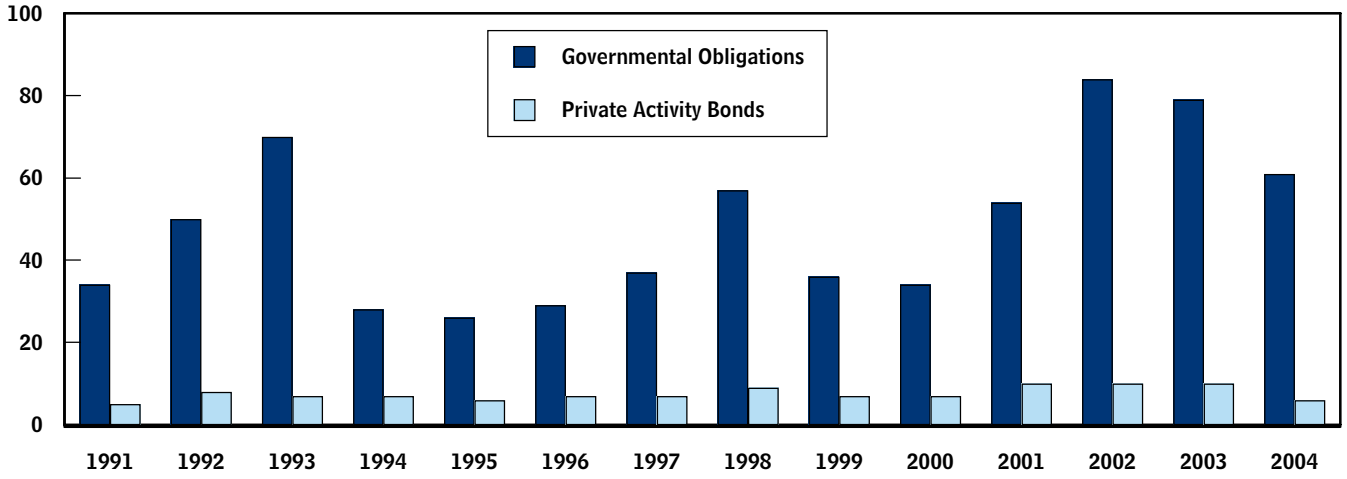
24. All of the data apply to long-term bonds (ones with maturities of 13 months or more), which are the predominant type of tax-exempt bond. According to the Internal Revenue Service, for governmental obligations, an infrastructure bond can fund either a transportation or utilities project. (From 1987 through 2005, typically between 85 percent and 90 percent of the value of the tax-exempt utilities bonds issued annually funded water supply and wastewater treatment facilities.) See Thomson Financial, *The Bond Buyer Yearbook* (New York, 2007 and earlier issues). Private activity infrastructure bonds may be issued to fund airports, docks and wharves, mass commuting and select surface transportation facilities, and water and sewage projects.

25. See ACI–NA Policy Center, *Reforming the Federal Tax Treatment of Airport Bonds, Executive Summary* (February 28, 2006), available upon request from the Airports Council International–North America at www.aci-na.org. Note, however, that the various sources of funding may not be entirely independent, because airport user charges can be used to secure or to pay off loans. Additionally, federal grants through the Airport Improvement Program appear to be more important to smaller airports than larger ones, because the latter are better able to tap financial markets to fund their capital projects. See Robert S. Kirk, *Airport Improvement Program: Issues for Congress*, CRS Report for Congress RL33891 (Congressional Research Service, February 26, 2007), p. 7.

Figure 10.

Governmental Obligations and Private Activity Bonds to Finance Public Infrastructure, 1991 to 2004

(Billions of dollars)



Source: Congressional Budget Office based on data from the Internal Revenue Service.

airports, private activity bonds provide some financing for highway and intermodal freight transfer facilities, mass transit and high-speed intercity rail, water transportation facilities, and water supply and wastewater treatment.[26]

According to OMB, the federal government's loss of revenues because of tax-exempt bonds—also referred to as tax expenditures—was about $23 billion in 2006. The agency provides an estimate only of the total amount, but because bonds that financed either transportation or water projects accounted for a stable share of about 27 percent of the total value of governmental obligations issued between 1991 and 2004, a reasonable inference of the loss of federal revenues in 2006 attributable to governmental obligations' financing public infrastructure is approximately $6.3 billion (27 percent of $23 billion).[27] For private activity bonds backing projects involving airports, docks, and similar transportation facilities (one of the two groups of projects for which estimates are available), the loss of federal revenues was about $1.1 billion in 2006, and for such bonds for water and sewer facilities (the other group), about $510 million.[28] Thus, the revenue loss to the federal government from all tax-exempt infrastructure bonds amounted to about $7.9 billion in 2006.[29]

That sum is over and above the $50.6 billion in federal grants and loan subsidies for infrastructure in 2006, but it overstates the amount by which tax exemptions on governmental obligations and private activity bonds actually

26. In 2005, The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users added highway and intermodal freight transfer facilities to the list of projects that can be financed through private activity bonds, with a cap of $15 billion on the amount of debt that can be issued (see P.L. 109-59, section 11143).

27. See *Budget of the United States Government, Fiscal Year 2008: Analytical Perspectives*, Table 19.2, "Estimates of Total Income Tax Expenditures," p. 294. An estimate of a loss in revenues does not imply an equivalent gain if the tax exemption was eliminated. In particular, the calculation of the tax expenditure does not take into account how the behavior of lenders would change as a result of removing the exemption.

28. Private activity bonds in OMB's category for water and sewer projects can also apply to the financing of hazardous waste disposal facilities. However, only a very small amount of such debt has been issued.

29. States typically exempt from taxation income from municipal bonds issued in state and, in a few cases, those issued out of state. However, states' income tax rates are much lower than the federal government's; hence, any forgone revenues for state governments would be as well—although estimates of such losses for states or municipalities are unavailable. See Thomson Financial, *The Bond Buyer Yearbook* (New York, 2007), pp. 118–119.

reduced states and localities' costs of borrowing to finance infrastructure projects: The savings in financing costs that states and localities gain through the tax exemption (and which is determined by the tax rate applied to municipal bond purchasers at the margin, that is, to those last purchasers who reflect the final extent of demand) are less than the federal revenues forgone from the tax exemption (which is determined by the tax rate of the average purchasers).Tax-exempt bond financing is generally not considered to be a cost-effective way of transferring revenues from the federal government to states and localities.[30]

The Supply of Public Infrastructure by the Private Sector

The federal government also fosters the private sector's support of infrastructure through other means. For example, private investment to improve the nation's surface transportation system (namely, highways and transit and rail systems) is encouraged through federal credit assistance made available under the Transportation Infrastructure Finance and Innovation Act (TIFIA) of 1998 (P.L. 105-178, sections 1501-1504). Through TIFIA, the federal government has contributed $3.2 billion (mostly in the form of direct loans) to projects with costs totaling $13.2 billion.[31] Businesses and commercial enterprises may also receive loans for projects involving water systems from state revolving funds that are capitalized with grants made by the Environmental Protection Agency.[32] Private entities are also eligible to receive federal grants through the Airport Improvement Program for the development or improvement of airports that are "significant to national air transportation."[33]

Public–Private Partnerships

Infrastructure projects in which a private entity plays a role beyond simply supplying its services to a government agency are often referred to as public–private partnerships. Among the various types of public infrastructure, such partnerships appear to be most common for projects involving highway and road transportation, rail, and water supply and wastewater treatment, which can lend themselves to private operation. For example, a private entity can control access to and charge for the use of a toll road or a drinking water system, whereas it would be harder to charge users to recoup costs given the more diffuse benefits from a dam or flood-control project.[34]

The fundamental difference between the traditional role of the private sector in infrastructure and the role it plays in a public–private partnership is the greater amount of risk that the private entity assumes in the partnership. The degree of risk for the private entity can range from almost complete responsibility to only a modest stake in the project. In some public–private partnerships for highway and road construction, for example, the private entity raises most or all of the funds and is also responsible for the design, construction, and operation and maintenance. It recoups its investment through charging user fees.[35] The Dulles Greenway highway in Virginia and the SR-91 and SR-125 toll roads in California are examples of the results of two such public–private partnerships. In contrast, having more-limited involvement, private enti-

30. See Statement of Donald B. Marron, Acting Director, Congressional Budget Office, *Economic Issues in the Use of Tax-Preferred Bond Financing,* before the Subcommittee on Federal Revenue Measures, House Committee on Ways and Means (March 16, 2006).

31. The federal government's financing share of such projects is capped at 33 percent, and projects that qualify must have investment grade credit ratings on the remaining debt they take on. As a result, of the total amount of credit that it has extended or guaranteed through TIFIA, the federal government has provided a credit subsidy of approximately $240 million by lending at interest rates lower than its own borrowing costs or by assuming defaulted debt. See TIFIA Joint Program Office, *TIFIA Credit Program Overview* (September 27, 2006), available at http://tifia.fhwa.dot.gov, and *Budget of the United States Government, Fiscal Year 2008: Department of Transportation*. In this paper, the outlays for credit subsidies under TIFIA are included in the data for indirect federal capital spending.

32. See Environmental Protection Agency, *Financing America's Clean Water Since 1987—A Report on Progress and Innovation*, EPA-832-R-00-011 (May 2001), pp. 2–3.

33. See Federal Aviation Administration, "National Plan of Integrated Airport Systems," available at www.faa.gov/airports_airtraffic/airports/planning_capacity/npias.

34. Those factors reflect two potential rationales for a government's role in providing infrastructure. First, because they can have high fixed (or up-front) costs and low marginal costs, infrastructure projects may lend themselves less well than other types of investment to a competitive market: It may be economically feasible for only one producer to undertake such a project, so some type of government intervention or regulation may be necessary in order to maintain the price and supply of the infrastructure services at or near a competitive and economically efficient level. Second, when it is not possible for a private entity to charge all who make use of infrastructure services on the basis of the benefits received, then the private sector may not provide enough of such services. A government could remedy that undersupply by recouping the cost of the infrastructure through taxation.

ties may simply bid to supply various services such as maintaining public roads or operating water supply facilities. In the more extensive type of public–private partnership, the risk to the private entity depends on the accuracy of predictions about many things, most important, construction and financing costs. In the partnerships based on contract services, the risk to the private partner depends on its ability to deliver agreed-upon services at the contract price.[36]

Several factors may have combined recently to make public–private partnerships more attractive to the various levels of government responsible for public infrastructure: in particular, a demand by the public for improved infrastructure services coupled with a large supply of investment funds, such as public- and private-sector pension funds, whose managers seek stable long-term returns.

However, potential drawbacks to the private sector's involvement in public infrastructure exist. For example, in cases in which private entities bid for the right to undertake infrastructure projects and/or provide services, too few bidders could (absent government scrutiny that allowed the competition to be called off) lead to a contract award that favored the private sector over taxpayers. Furthermore, profit-driven behavior in the private sector may sometimes not be compatible with public goals for infrastructure (for instance, ensuring access to all). Finally, if the private entity responsible for a particular type of public infrastructure fails to complete the project, the government may need to step in to provide services.

According to a regularly cited survey, the cumulative project costs of public–private partnerships in the United States that had been funded or completed by October 2006 totaled a bit over $48 billion (in nominal dollars).[37] In contrast, nominal capital spending on infrastructure by the federal government and states and localities totaled $1.6 trillion between 1985 and 2004 (averaging $80 billion annually). Hence, public–private partnerships—and the amount of private-sector funds committed to them—have not accounted for a significant share of public infrastructure spending in the United States. Other studies have come to a similar conclusion for highway and transit projects.[38]

35. The risk to the private entity of not recouping its investment is often reduced by advantageous financing available through government sponsorship of the project and by terms granting the private entity the exclusive right to provide the infrastructure services.

36. An extensive treatment of public–private partnerships in transportation can be found in Department of Transportation, *Report to Congress on Public–Private Partnerships* (December 2004), available at www.fhwa.dot.gov/reports/pppdec2004/index.htm.

37. The figure is based on data from the 2006 International Major Projects Survey, which accompanied *Public Works Financing,* vol. 209 (October 2006). The data have important limitations: For the purposes of this analysis in particular, they do not distinguish between the public- and private-sector components of such projects. More generally, the data were not collected to provide an exhaustive inventory of public–private partnerships and, as a result, probably understate the extent of them.

38. See General Accounting Office, *Private Sector Sponsorship and Investment in Major Projects Has Been Limited*, GAO-04-419 (March 2004).

Appendix: Spending on Transportation and Water Infrastructure Since 1956

The tables in this appendix provide the amounts spent year by year on transportation and water infrastructure since 1956 and are the basis for the figures that appear in the text.

Table A-1.

Public Spending on Infrastructure, 1956 to 2004

(Millions of 2006 dollars)

		Federal		State and Local	
	Total	Amount	Percent	Amount	Percent
1956	105,628	15,998	15.1	89,630	84.9
1957	113,215	18,713	16.5	94,503	83.5
1958	120,683	24,032	19.9	96,651	80.1
1959	133,742	36,972	27.6	96,769	72.4
1960	131,273	40,100	30.5	91,173	69.5
1961	136,779	38,531	28.2	98,247	71.8
1962	138,190	39,047	28.3	99,143	71.7
1963	146,238	41,600	28.4	104,638	71.6
1964	149,125	45,746	30.7	103,379	69.3
1965	153,831	48,767	31.7	105,064	68.3
1966	156,140	47,603	30.5	108,537	69.5
1967	157,852	46,653	29.6	111,199	70.4
1968	157,794	46,439	29.4	111,355	70.6
1969	159,029	44,767	28.2	114,262	71.8
1970	156,969	43,437	27.7	113,532	72.3
1971	164,791	47,591	28.9	117,200	71.1
1972	168,620	47,071	27.9	121,549	72.1
1973	163,206	48,415	29.7	114,791	70.3
1974	158,743	48,785	30.7	109,958	69.3
1975	170,699	52,877	31.0	117,822	69.0
1976	173,644	62,419	35.9	111,225	64.1
1977	173,609	66,496	38.3	107,113	61.7
1978	177,147	64,658	36.5	112,489	63.5
1979	189,598	68,504	36.1	121,094	63.9
1980	196,318	74,060	37.7	122,258	62.3
1981	194,547	70,478	36.2	124,070	63.8

Continued

Table A-1.

Continued

		Federal		State and Local	
	Total	Amount	Percent	Amount	Percent
1982	185,053	59,417	32.1	125,636	67.9
1983	187,699	56,140	29.9	131,559	70.1
1984	192,071	58,292	30.3	133,779	69.7
1985	202,740	60,744	30.0	141,996	70.0
1986	213,993	61,951	29.0	152,042	71.0
1987	220,775	55,150	25.0	165,624	75.0
1988	228,880	56,514	24.7	172,366	75.3
1989	233,906	55,562	23.8	178,344	76.2
1990	239,220	56,728	23.7	182,491	76.3
1991	237,175	57,159	24.1	180,016	75.9
1992	243,268	60,049	24.7	183,219	75.3
1993	245,042	59,871	24.4	185,171	75.6
1994	253,712	62,384	24.6	191,328	75.4
1995	258,517	62,859	24.3	195,658	75.7
1996	260,850	61,779	23.7	199,071	76.3
1997	268,005	62,118	23.2	205,887	76.8
1998	274,113	62,910	23.0	211,203	77.0
1999	283,936	65,339	23.0	218,597	77.0
2000	290,518	68,180	23.5	222,338	76.5
2001	305,811	77,956	25.5	227,855	74.5
2002	317,570	81,146	25.6	236,424	74.4
2003	319,110	77,934	24.4	241,176	75.6
2004	312,217	73,517	23.5	238,700	76.5

Source: Congressional Budget Office.

Note: State and local spending is reported net of federal grants and loan subsidies. Those data do not include expenditures on freight rail or, after 1990, water resources.

Table A-2.

Federal Spending on Infrastructure as a Share of Nondefense Expenditures, 1956 to 2006

(Percentage)

	Share of Total Federal Spending	Share of Nondefense Expenditures		Share of Total Federal Spending	Share of Nondefense Expenditures
1956	2.6	6.5	1982	3.7	4.9
1957	2.9	7.1	1983	3.3	4.5
1958	3.5	8.2	1984	3.4	4.7
1959	4.9	10.4	1985	3.3	4.5
1960	5.3	11.2	1986	3.3	4.6
1961	5.0	10.2	1987	3.0	4.2
1962	4.8	9.4	1988	3.0	4.1
1963	5.0	9.6	1989	2.8	3.9
1964	5.3	9.8	1990	2.8	3.6
1965	5.8	10.1	1991	2.7	3.4
1966	5.2	9.2	1992	2.8	3.6
1967	4.6	8.3	1993	2.8	3.6
1968	4.2	7.8	1994	2.9	3.6
1969	4.2	7.6	1995	2.9	3.6
1970	4.2	7.1	1996	2.8	3.4
1971	4.6	7.3	1997	2.8	3.4
1972	4.4	6.6	1998	2.8	3.4
1973	4.5	6.5	1999	2.9	3.5
1974	4.5	6.4	2000	3.0	3.6
1975	4.4	6.0	2001	3.4	4.1
1976	4.9	6.5	2002	3.4	4.1
1977	5.1	6.7	2003	3.1	3.9
1978	4.7	6.1	2004	2.9	3.6
1979	4.9	6.3	2005	2.9	3.6
1980	5.0	6.4	2006	2.9	3.5
1981	4.5	5.9			

Source: Congressional Budget Office.

Table A-3.

Public Spending on Infrastructure as a Percentage of Gross Domestic Product, 1956 to 2004

	Total	Capital	Operation and Maintenance		Total	Capital	Operation and Maintenance
1956	2.58	1.58	1.00	1981	2.66	1.22	1.43
1957	2.73	1.67	1.06	1982	2.58	1.15	1.43
1958	2.92	1.84	1.08	1983	2.51	1.09	1.42
1959	3.06	1.93	1.13	1984	2.41	1.05	1.36
1960	2.94	1.80	1.15	1985	2.46	1.09	1.36
1961	3.04	1.84	1.20	1986	2.52	1.14	1.38
1962	2.94	1.81	1.13	1987	2.54	1.17	1.38
1963	3.02	1.85	1.17	1988	2.52	1.17	1.35
1964	2.93	1.81	1.12	1989	2.48	1.14	1.35
1965	2.87	1.76	1.11	1990	2.51	1.14	1.36
1966	2.78	1.69	1.10	1991	2.48	1.15	1.33
1967	2.80	1.69	1.11	1992	2.46	1.11	1.35
1968	2.70	1.60	1.10	1993	2.42	1.07	1.35
1969	2.68	1.57	1.11	1994	2.42	1.05	1.37
1970	2.71	1.54	1.17	1995	2.42	1.05	1.37
1971	2.82	1.59	1.23	1996	2.36	1.02	1.34
1972	2.78	1.57	1.21	1997	2.33	1.00	1.33
1973	2.59	1.41	1.18	1998	2.30	1.00	1.30
1974	2.57	1.38	1.19	1999	2.31	1.03	1.28
1975	2.79	1.48	1.31	2000	2.33	1.06	1.27
1976	2.70	1.41	1.29	2001	2.45	1.11	1.34
1977	2.60	1.26	1.34	2002	2.52	1.16	1.36
1978	2.49	1.16	1.33	2003	2.51	1.16	1.36
1979	2.59	1.27	1.32	2004	2.40	1.10	1.30
1980	2.73	1.36	1.37				

Source: Congressional Budget Office.

Note: Data on state and local spending do not include expenditures on freight rail or, after 1990, water resources.

Table A-4.

Public Spending for Infrastructure Capital and Related Operation and Maintenance, 1956 to 2004

(Millions of 2006 dollars)

		Capital		Operation and Maintenance	
	Total	Amount	Percent	Amount	Percent
1956	105,628	64,694	61	40,934	39
1957	113,215	69,315	61	43,901	39
1958	120,683	75,905	63	44,777	37
1959	133,742	84,583	63	49,159	37
1960	131,273	80,320	61	50,953	39
1961	136,779	82,999	61	53,780	39
1962	138,190	85,107	62	53,083	38
1963	146,238	89,740	61	56,498	39
1964	149,125	92,258	62	56,867	38
1965	153,831	94,710	62	59,121	38
1966	156,140	94,896	61	61,244	39
1967	157,852	95,461	60	62,391	40
1968	157,794	93,864	59	63,930	41
1969	159,029	93,762	59	65,268	41
1970	156,969	89,581	57	67,388	43
1971	164,791	93,828	57	70,963	43
1972	168,620	95,728	57	72,892	43
1973	163,206	89,414	55	73,792	45
1974	158,743	85,390	54	73,354	46
1975	170,699	91,267	53	79,432	47
1976	173,644	91,116	52	82,528	48
1977	173,609	84,176	48	89,433	52
1978	177,147	82,950	47	94,197	53
1979	189,598	93,086	49	96,511	51
1980	196,318	97,973	50	98,345	50
1981	194,547	90,080	46	104,468	54

Continued

Table A-4.

Continued

		Capital		Operation and Maintenance	
	Total	Amount	Percent	Amount	Percent
1982	185,053	82,615	45	102,438	55
1983	187,699	81,867	44	105,833	56
1984	192,071	83,746	44	108,325	56
1985	202,740	90,474	45	112,266	55
1986	213,993	97,010	45	116,983	55
1987	220,775	101,297	46	119,477	54
1988	228,880	106,175	46	122,706	54
1989	233,906	107,040	46	126,865	54
1990	239,220	109,223	46	129,997	54
1991	237,175	109,731	46	127,444	54
1992	243,268	109,879	45	133,389	55
1993	245,042	108,533	44	136,509	56
1994	253,712	110,036	43	143,677	57
1995	258,517	111,896	43	146,622	57
1996	260,850	112,546	43	148,304	57
1997	268,005	115,366	43	152,640	57
1998	274,113	119,438	44	154,675	56
1999	283,936	126,958	45	156,978	55
2000	290,518	131,752	45	158,766	55
2001	305,811	138,693	45	167,118	55
2002	317,570	145,867	46	171,703	54
2003	319,110	146,935	46	172,175	54
2004	312,217	143,557	46	168,659	54

Source: Congressional Budget Office.

Note: Data on state and local spending do not include expenditures on freight rail or, after 1990, water resources.

Table A-5.

Federal Spending for Infrastructure Capital and Related Operation and Maintenance, 1956 to 2006

(Millions of 2006 dollars)

		Capital		Operation and Maintenance	
	Total	Amount	Percent	Amount	Percent
1956	15,998	11,903	74	4,095	26
1957	18,713	14,140	76	4,572	24
1958	24,032	20,408	85	3,624	15
1959	36,972	30,969	84	6,003	16
1960	40,100	33,692	84	6,407	16
1961	38,531	31,437	82	7,094	18
1962	39,047	32,382	83	6,665	17
1963	41,600	34,405	83	7,195	17
1964	45,746	38,525	84	7,221	16
1965	48,767	40,545	83	8,222	17
1966	47,603	39,260	82	8,342	18
1967	46,653	38,019	81	8,634	19
1968	46,439	37,353	80	9,086	20
1969	44,767	35,212	79	9,555	21
1970	43,437	33,310	77	10,127	23
1971	47,591	35,712	75	11,880	25
1972	47,071	35,357	75	11,714	25
1973	48,415	35,698	74	12,718	26
1974	48,785	36,655	75	12,130	25
1975	52,877	38,647	73	14,230	27
1976	62,419	46,545	75	15,873	25
1977	66,496	50,219	76	16,277	24
1978	64,658	46,773	72	17,884	28
1979	68,504	51,013	74	17,490	26
1980	74,060	55,400	75	18,660	25
1981	70,478	47,922	68	22,556	32

Continued

Table A-5.

Continued

		Capital		Operation and Maintenance	
	Total	Amount	Percent	Amount	Percent
1982	59,417	42,352	71	17,065	29
1983	56,140	40,818	73	15,322	27
1984	58,292	43,083	74	15,209	26
1985	60,744	45,612	75	15,132	25
1986	61,951	47,752	77	14,199	23
1987	55,150	41,313	75	13,837	25
1988	56,514	42,571	75	13,943	25
1989	55,562	41,074	74	14,488	26
1990	56,728	42,475	75	14,253	25
1991	57,159	42,820	75	14,339	25
1992	60,049	43,508	72	16,541	28
1993	59,871	44,103	74	15,768	26
1994	62,384	44,828	72	17,556	28
1995	62,859	45,348	72	17,511	28
1996	61,779	44,552	72	17,228	28
1997	62,118	43,942	71	18,176	29
1998	62,910	45,959	73	16,951	27
1999	65,339	49,135	75	16,204	25
2000	68,180	52,829	77	15,352	23
2001	77,956	58,673	75	19,283	25
2002	81,146	62,242	77	18,904	23
2003	77,934	59,259	76	18,675	24
2004	73,517	56,332	77	17,185	23
2005	73,646	55,102	75	18,544	25
2006	76,334	56,344	74	19,990	26

Source: Congressional Budget Office.

Table A-6.

State and Local Spending for Infrastructure Capital and Related Operation and Maintenance, 1956 to 2004

(Millions of 2006 dollars)

		Capital		Operation and Maintenance	
	Total	Amount	Percent	Amount	Percent
1956	89,630	52,791	59	36,839	41
1957	94,503	55,174	58	39,328	42
1958	96,651	55,497	57	41,154	43
1959	96,769	53,613	55	43,156	45
1960	91,173	46,627	51	44,546	49
1961	98,247	51,561	52	46,686	48
1962	99,143	52,725	53	46,418	47
1963	104,638	55,335	53	49,303	47
1964	103,379	53,733	52	49,647	48
1965	105,064	54,165	52	50,899	48
1966	108,537	55,635	51	52,901	49
1967	111,199	57,441	52	53,758	48
1968	111,355	56,511	51	54,844	49
1969	114,262	58,549	51	55,713	49
1970	113,532	56,271	50	57,261	50
1971	117,200	58,116	50	59,083	50
1972	121,549	60,371	50	61,179	50
1973	114,791	53,717	47	61,074	53
1974	109,958	48,735	44	61,223	56
1975	117,822	52,620	45	65,202	55
1976	111,225	44,571	40	66,654	60
1977	107,113	33,957	32	73,155	68
1978	112,489	36,177	32	76,312	68
1979	121,094	42,073	35	79,021	65
1980	122,258	42,573	35	79,685	65
1981	124,070	42,158	34	81,912	66

Continued

Table A-6.
Continued

		Capital		Operation and Maintenance	
	Total	Amount	Percent	Amount	Percent
1982	125,636	40,263	32	85,373	68
1983	131,559	41,049	31	90,511	69
1984	133,779	40,663	30	93,116	70
1985	141,996	44,862	32	97,134	68
1986	152,042	49,258	32	102,784	68
1987	165,624	59,984	36	105,640	64
1988	172,366	63,604	37	108,763	63
1989	178,344	65,967	37	112,378	63
1990	182,491	66,747	37	115,744	63
1991	180,016	66,911	37	113,105	63
1992	183,219	66,371	36	116,848	64
1993	185,171	64,430	35	120,741	65
1994	191,328	65,207	34	126,121	66
1995	195,658	66,548	34	129,110	66
1996	199,071	67,994	34	131,077	66
1997	205,887	71,424	35	134,464	65
1998	211,203	73,479	35	137,724	65
1999	218,597	77,823	36	140,774	64
2000	222,338	78,923	35	143,415	65
2001	227,855	80,020	35	147,835	65
2002	236,424	83,625	35	152,799	65
2003	241,176	87,677	36	153,500	64
2004	238,700	87,226	37	151,474	63

Source: Congressional Budget Office.

Note: State and local spending is reported net of federal grants and loan subsidies. Those data do not include expenditures on freight rail or, after 1990, water resources.