CONGRESS OF THE UNITED STATES
CONGRESSIONAL BUDGET OFFICE

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CBO
STUDY

NOVEMBER 2010

Public Spending on Transportation and Water Infrastructure

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Pub. No. 4088

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STUDY

Public Spending on Transportation and Water Infrastructure

November 2010

The Congress of the United States ■ Congressional Budget Office

Notes

Data on the federal government's outlays for transportation and water infrastructure are available through fiscal year 2009 and include spending that year under the American Recovery and Reinvestment Act. In contrast, the most recent data on spending by state and local governments that span a 12-month period matching the federal fiscal year (October 1 through September 30) are from 2007. Therefore, to be able to express state and local spending for infrastructure on an annual basis that is consistent with federal fiscal years, the Congressional Budget Office reports total public spending for infrastructure—the sum of federal expenditures and state and local expenditures—through 2007.

Dollar values that have been adjusted for inflation—that are reported in "real" or "constant" terms—are expressed in 2009 dollars.

Unless stated otherwise, spending by states and localities for infrastructure has been reduced by the amount of grants and loan subsidies they received from the federal government. The value of those grants and loan subsidies is included in the totals reported for federal spending on that infrastructure.

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

Preface

The nation's transportation and water infrastructure—its highways, airports, water supply systems, wastewater treatment plants, and other facilities—plays a vital role in the economy. Private commercial activities and the daily lives of individuals depend on that physical infrastructure, which is provided by all levels of government in the United States. Concerns about the nation's infrastructure and its ability to support commerce and promote public well-being have prompted calls for greater infrastructure spending. The Congress is currently considering the level of funding for the next several years for important federal infrastructure programs, such as highways, mass transit, and aviation. Crucial to such decisionmaking is information about how much the federal government and state and local governments have spent over time to build, improve, and rehabilitate physical infrastructure, as well as to operate and maintain existing facilities.

In response to a request from the Chairman and Ranking Member of the Senate Committee on Finance, the Congressional Budget Office (CBO) prepared this study, which analyzes recent developments in spending on transportation and water infrastructure, trends in spending for capital and for operations and maintenance by the various levels of government, and the rationale for public spending on infrastructure. This study updates a previous report that CBO published in August 2007, *Trends in Public Spending on Transportation and Water Infrastructure, 1956 to 2004.* In keeping with CBO's mandate to provide objective, impartial analysis, this report makes no recommendations.

Nathan Musick of CBO's Microeconomic Studies Division wrote the study under the supervision of Joseph Kile and David Moore. Mary Froehlich of CBO provided data on federal infrastructure outlays under the American Recovery and Reinvestment Act of 2009 and Sarah Miller, formerly of CBO, provided research assistance. Jeffrey Holland and Sarah Puro reviewed early drafts of the manuscript and supplied useful feedback, and Mark Booth, Peter Fontaine, and Benjamin Page offered helpful comments. CBO would also like to thank the following: Jessie LaVine of the Office of Management and Budget and Joseph Dalaker of the Census Bureau, who supplied the primary data on infrastructure spending; William Holtzman of the Army Corps of Engineers, and Nicole Carter, Robert Kirk and William Mallett of the Congressional Research Service, who provided additional information about public infrastructure spending; Brian Parks of the Bureau of Economic Analysis, Lana Borgie of the Bureau of Labor Statistics, Lee Joung of the American Association of State Highway and Transportation Officials, Ken Simonson of the Associated General Contractors

of America, and Tian Liu of Cemex, who provided insights about recent trends in infrastructure construction costs. (The assistance of outside reviewers implies no responsibility for the final product, which rests solely with CBO.)

Loretta Lettner edited the study, and Kate Kelly proofread it. Maureen Costantino designed the cover, and Jeanine Rees prepared the document for publication. Monte Ruffin oversaw the printing of the report, Linda Schimmel handled the print distribution, and Simone Thomas prepared the electronic version for CBO's Web site (www.cbo.gov).

Douglas W. Elmendorf
Director

November 2010

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Summary

In fiscal year 2007—the most recent year for which data on combined spending by the federal government and by state and local governments are available—total public spending for transportation and water infrastructure was $356 billion, or 2.4 percent of the nation's economic output as measured by its gross domestic product. For the purposes of this study, transportation and water infrastructure encompasses infrastructure for all forms of surface transportation (highways, mass transit, rail, and waterways), aviation, water resources (such as dams and levees), and water distribution and wastewater treatment.

Recent Developments in Public Spending for Transportation and Water Infrastructure

Between 2003 and 2007, real (inflation-adjusted) public spending on transportation and water infrastructure declined by $23 billion, or 6 percent. That decline, which reflects a decrease in real capital spending, especially by the federal government, stands in contrast to the fairly steady increase in spending for such infrastructure during the previous two decades. In particular, real capital spending on highways, mass transit, and aviation fell markedly even as capital spending on other types of infrastructure—such as rail and water transportation, water resources, and water supply and wastewater treatment—remained stable or rose. The drop in real capital spending for highways, mass transit, and aviation between 2003 and 2007 was primarily the result of a sharp increase in prices for materials used to build such infrastructure—an increase that outpaced the growth of nominal (current-dollar) spending on those types of infrastructure.

In 2009, the federal government spent $87 billion on transportation and water infrastructure, an increase of $6 billion over the amount spent in 2007. Of those outlays, about $4 billion was made available through the American Recovery and Reinvestment Act of 2009 (ARRA). In total, lawmakers appropriated $62 billion in funding for transportation and water infrastructure under that legislation. The Congressional Budget Office expects that, in nominal terms, federal spending for transportation and water infrastructure under ARRA will total $54 billion through 2013, by which time almost 90 percent of the funds made available for infrastructure through ARRA will have been spent.

The Composition of Public Spending for Transportation and Water Infrastructure

The composition of public spending on transportation and water infrastructure can be represented in three ways: by the level of government providing the funding or other form of financial support; by the nature of the spending (whether it is designated for capital projects or for operation and maintenance); and by the type of infrastructure. State and local governments account for about 75 percent of total public spending on transportation and water infrastructure—even after subtracting from their gross spending the value of grants and loan subsidies that the federal government provides for such purposes—and the federal government accounts for the other 25 percent. That split has remained roughly constant over the past two decades.

In recent years, not quite half of total public funding for transportation and water infrastructure in the United States has been devoted to capital spending for activities such as construction and equipment purchases. State and local governments have accounted for about 60 percent of those expenditures, and the federal government has accounted for about 40 percent. A little more than half of total public spending for such infrastructure has been used for operation and maintenance, of which state and local governments have provided about 90 percent.

Although the federal government has played a limited role in the funding of operation and maintenance for transportation and water infrastructure as a whole, it has provided much of the funding for operating and maintaining the nation's air traffic control system.

Spending on highways at all levels of government accounted for 43 percent of expenditures for transportation and water infrastructure in 2007. Expenditures on water supply and wastewater treatment systems accounted for 28 percent of spending; aviation, mass transit and rail made up 23 percent; and the remaining categories of water transportation and water resources accounted for 5 percent.

The Role of Government in Funding Transportation and Water Infrastructure

In the United States, the public sector rather than the private sector typically provides funding for transportation and water infrastructure. Whether it is more efficient for the federal government to provide that funding depends on the type of infrastructure and the likelihood that such infrastructure will be undersupplied if its provision is left to state and local governments or to the private sector.

Evidence suggests that spending for carefully selected infrastructure projects can contribute to long-term economic growth by increasing the capital stock and raising productivity. (During a prolonged economic downturn, infrastructure spending can also mitigate losses in output and employment.) Realizing the potential gains from public spending for transportation and water infrastructure depends crucially on identifying economically justifiable projects—those with benefits to society that are expected to outweigh costs—but a variety of factors make identifying such projects difficult. In addition, the demand for infrastructure could be better aligned with the existing supply by putting a price on those services that reflects the full cost of using infrastructure, including both the cost of providing infrastructure services and the costs that one person's use imposes on others. The federal government could make its current funding more effective by ensuring that the costs of infrastructure projects are allocated across levels of government on the basis of where the benefits are expected to accrue. Otherwise, for example, federal funding for infrastructure that provided benefits primarily at the local level could result in too many projects, or projects that are too expensive, being undertaken. In addition, individuals and businesses might consume too many infrastructure services relative to the cost of providing those services—because the federal share of that cost is largely borne not by local residents but by taxpayers throughout the country. ◆

Public Spending on Transportation and Water Infrastructure

Introduction

The nation's physical infrastructure—including the facilities and systems that support transportation, provide water resources, ensure safe and adequate supplies of fresh water, and treat wastewater—plays a critical role in facilitating commerce and, more broadly, in promoting public well-being. Reports of problems associated with surface transportation and air travel, as well as concerns about the quality and safety of water supplies, have raised questions about the state of the nation's infrastructure. According to one study, the number of hours wasted per driver in rush-hour traffic because of congestion more than doubled between 1982 and 1997; since then, that number has continued to rise.[1] According to another study, nearly 20 percent of air passengers experienced flight disruptions that, on average, added an estimated 105 minutes to their travel time.[2]

Those and related developments will be pertinent as the Congress considers reauthorizing multiyear infrastructure programs that fund highways and roads, mass transit, and aviation facilities and services. Key to those and other deliberations about the federal government's infrastructure policy is determining the following: the appropriate amount of funding to allocate to various types of infrastructure and to specific projects; the share of funding that would be optimally provided at the federal, state, and local levels; and the share of the cost that should be borne by the consumers who use those services. Fundamental to such decisionmaking are analyses of data that describe expenditures on various types of infrastructure at the federal level and at the state and local level.

This Congressional Budget Office (CBO) study updates previous reports on public spending for transportation and water infrastructure.[3] It describes expenditures by the federal government and by state and local governments from 1956, when the Federal-Aid Highway Act authorized construction of the country's interstate highway system, through 2007. In addition to providing detail on the composition of public infrastructure spending—for example, the amount of outlays devoted to capital expenditures versus operation and maintenance—CBO also explores recent developments in spending for infrastructure. In particular, the report examines the decline in real (inflation-adjusted) capital spending that occurred after 2003 and the effects on spending of the American Recovery and Reinvestment Act of 2009 (ARRA, Public Law 111-5).

Data on the federal government's outlays for transportation and water infrastructure are available through fiscal year 2009 and therefore reflect spending that year under ARRA. In contrast, the most recent data on state and local spending (spanning a 12-month period matching the federal fiscal year) are from 2007. Therefore, to be able to express state and local spending on an annual basis that is consistent with federal fiscal years, CBO reports total public spending—the sum of federal expenditures

1. David Schrank and Tim Lomax, *2009 Urban Mobility Report* (College Station, Texas: Texas A&M University System, Texas Transportation Institute, July 2009), available at http://mobility.tamu.edu/ums/report.

2. Lance Sherry, Guillermo Calderon-Meza, and Ashwin Samant, "Trends in Airline Passenger Trip Delays, 2007–2009" (paper presented at the 2010 Integrated Communications Navigation and Surveillance Conference, Herndon, Va., May 11–13, 2010), available at http://catsr.ite.gmu.edu/pubs/2010-ICNS-Pax TripDelay[1].pdf.

3. For the most recent paper in that series, see Congressional Budget Office, *Trends in Public Spending on Transportation and Water Infrastructure, 1956 to 2004* (August 2007).

and state and local expenditures—through 2007. (For a complete discussion of the methodology CBO used to produce this report, as well as definitions and data sources, see Appendix B.)

In the United States, funding for the types of infrastructure covered in this study is typically provided by the public sector rather than the private sector. About three-quarters of that funding is supplied by state and local governments, with the federal government providing the remainder. Almost one-half of the public sector's spending on transportation and water infrastructure consists of capital outlays—primarily for the purchase, construction, rehabilitation, or improvement of physical assets, such as highways, waterways, and water treatment plants. The remaining portion of public expenditures consists of noncapital outlays—primarily for the operation and maintenance of physical assets.[4]

Although different definitions of "infrastructure" exist, this report focuses on two types that claim a significant amount of federal resources: transportation and water. Those types of infrastructure 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 U.S. economy, of the public sector's funding of infrastructure.

For the purposes of CBO's analysis, "transportation infrastructure" includes the systems and facilities that support the following types of activities:

- **Vehicular transportation:** highways, roads, bridges, and tunnels;
- **Mass transit:** subways, buses, and commuter rail;
- **Rail transport:** primarily the intercity passenger service provided by Amtrak;[5]
- **Civil aviation:** airport terminals, runways, and taxiways, and facilities and navigational equipment for air traffic control; and
- **Water transportation:** waterways, ports, vessels, and navigational systems.

The category "water infrastructure" includes facilities that provide the following:

- **Water resources:** containment systems, such as dams, levees, reservoirs, and watersheds; and sources of fresh water such as lakes and rivers; and
- **Water utilities:** supply systems for distributing potable water, and wastewater and sewage treatment systems and plants.

Consistent with CBO's previous reports on public spending for transportation and water infrastructure, this update excludes spending that is associated with such infrastructure but does not contribute directly to the provision of infrastructure facilities or certain strictly defined infrastructure services. Examples of excluded spending are federal outlays for homeland security (which are especially pertinent to aviation), law enforcement and military functions (such as those carried out by the Coast Guard), and cleanup operations (such as those conducted by the Army Corps of Engineers following Hurricane Katrina in 2005).

Recent Developments in Public Spending for Transportation and Water Infrastructure

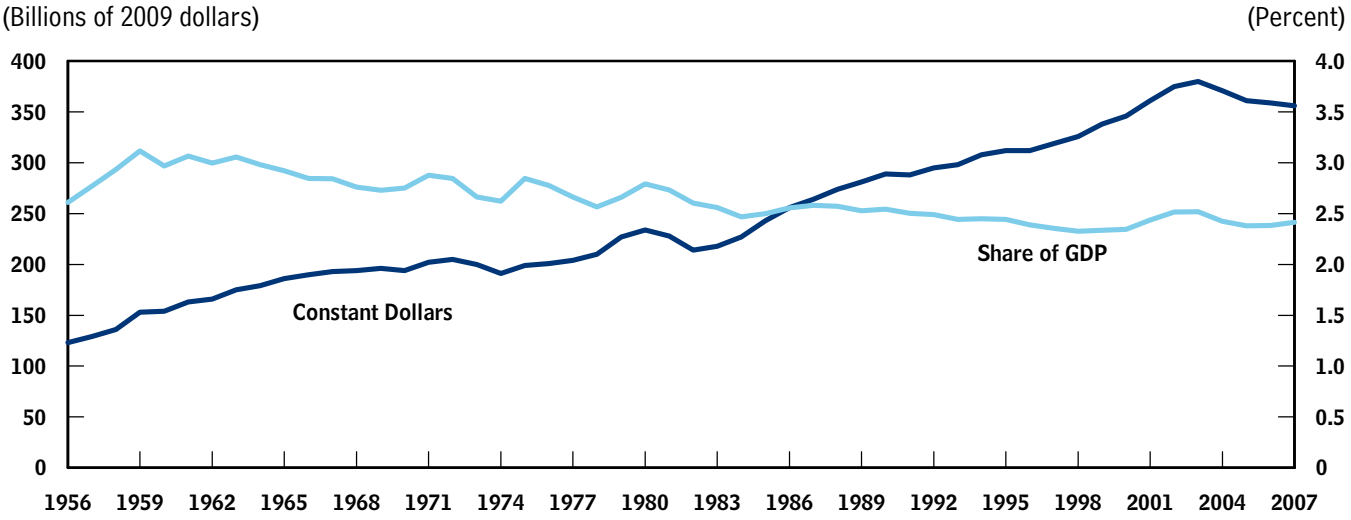
Two major developments have marked public spending on transportation and water infrastructure during the past decade. First, construction costs for several types of transportation infrastructure rose rapidly from 2003 to 2007, sharply outpacing the growth in nominal (current-

4. Much of the infrastructure spending that CBO terms "operation and maintenance" is classified by the Office of Management and Budget as expenditures for "noninvestment activities"; the corresponding classification by the Census Bureau is "current operations." As defined by CBO, however, operation and maintenance spending also includes investment in intangible assets for instance, for research and development) as well as expenditures for administrative activities and public outreach (such as safety and educational programs).

5. Although the federal government provides some funding for freight rail—in particular to cover expenses incurred by the Surface Transportation Board for performing certain regulatory and oversight functions—its financial support is limited because freight rail is effectively in the hands of the private sector. State and local governments do not report their expenditures for freight rail to the Census Bureau, and they include expenditures for passenger rail in the "mass transit" category.

Figure 1.

Total Public Spending for Transportation and Water Infrastructure in Constant Dollars and as a Share of GDP, 1956 to 2007



Source: Congressional Budget Office.

Notes: Total public spending is the sum of expenditures by the federal government and by state and local governments.

For the purposes of this analysis, the phrase "transportation and water infrastructure" encompasses the facilities and systems that support transportation, provide water resources, supply drinking water, and treat wastewater.

Spending expressed in constant dollars has been adjusted to reflect the effects of inflation between the year the spending occurred and a base year, which in this study is 2009.

GDP = gross domestic product.

dollar) spending for such infrastructure.[6] Consequently, in real terms, spending fell during that period. Second, stimulus spending under ARRA provided about $4 billion for infrastructure in 2009 and is expected to lead to an additional $49 billion in spending from 2010 through 2013.

The Decline in Total Public Spending from 2003 to 2007

Measured in constant dollars, total public spending for transportation and water infrastructure in 2007 amounted to $356 billion—$23 billion (or 6 percent) below the level of funding provided in 2003. The decline in overall spending for such infrastructure from 2003 to 2007 represents the most recent in a series of departures from a long-term pattern of annual growth since the mid-1950s (see Figure 1 and Table A-1 on page 22)[7]. As a share of gross domestic product, spending on transportation and water infrastructure fell only slightly between 2003 and 2007, from 2.5 percent to 2.4 percent.

The decline in real public spending on transportation and water infrastructure between 2003 and 2007 primarily reflects a drop in real capital expenditures, especially at the federal level. After peaking in the early 2000s, real federal capital outlays dropped by 6.2 percent annually; real capital expenditures at the state and local level fell by an average of 2.4 percent a year. In contrast, annual real public spending on the operation and maintenance of such infrastructure by the federal government and by state and local governments was essentially flat during that period. However, capital expenditures account for almost one-half of total public spending on transporta-

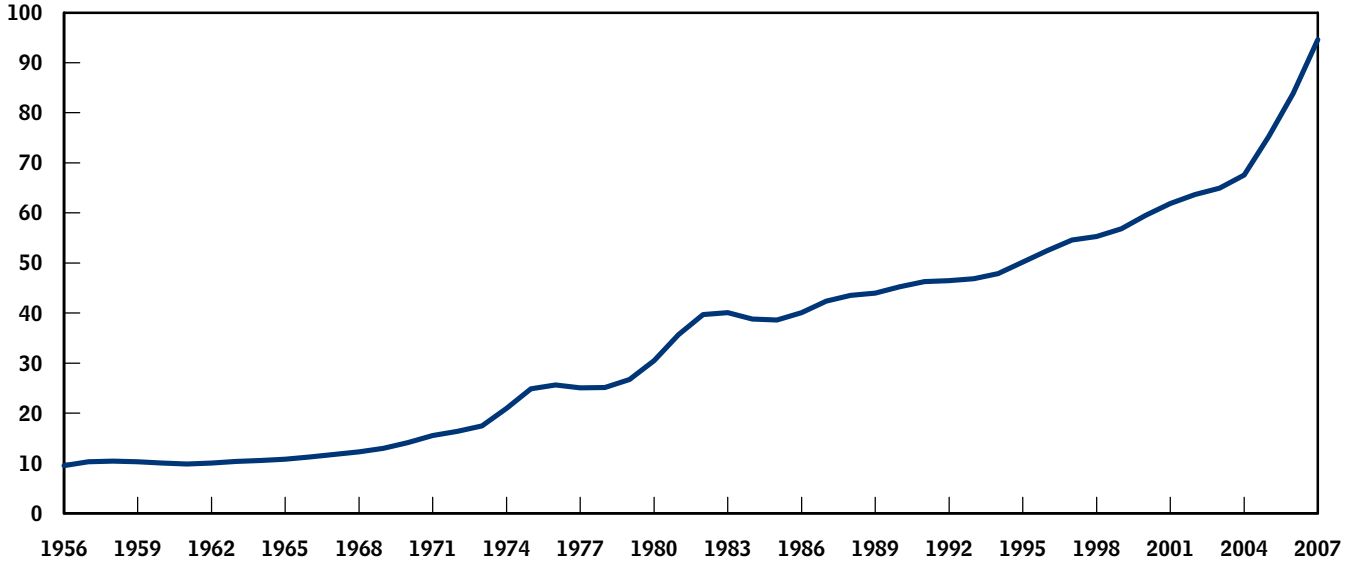
6. Funding or spending expressed in nominal dollars indicates the amount of funding or spending over a given period without an adjustment for inflation. Funding or spending expressed in real or constant-dollar terms has been adjusted to reflect the effects of inflation between the year the funding or spending occurred and a base year, which in this study is 2009.

7. In addition to the tables in Appendix A, a Web supplement to this report provides greater detail on spending.

Figure 2.

Highway Construction Price Index, 1956 to 2007

(Index value = 100 in 2009)



Source: Bureau of Economic Analysis.

tion and water infrastructure, so real total spending declined each year, by an average of 1.6 percent.

The decline in real capital spending after 2003 was attributable primarily to a sharp increase in the cost of construction, which was not met with a corresponding increase in nominal spending. The cost of highway and road construction, as measured by the highway construction price index, increased much more rapidly after 2003 than it did beforehand (see Figure 2).[8] Specifically, costs increased by an average of 10 percent a year from 2003 to 2007, compared with an average annual increase of 2.4 percent during the two decades preceding 2003. The cost of building other types of transportation structures increased 9 percent annually during that period, also a much more rapid rate of increase than had occurred in previous years.

Increases in the prices of materials that are key components of highway construction pushed up overall costs sharply. The cost of building highways and other transportation facilities is especially sensitive to changes in the price of commodities used to produce them because those projects offer relatively few possibilities for builders to replace more costly materials with cheaper alternatives. From 2003 to 2007, an increase in demand for petroleum products and other commodities elsewhere in the world (particularly in China and other developing nations), combined with the growth of residential and commercial construction in the United States, generated sustained upward pressure on the prices of energy and the materials widely used in highway construction. The price of petroleum, from which asphalt and diesel fuel are derived, rose 21 percent annually over that period. In addition, other materials used in highway construction also posted large annual increases from 2003 to 2007: the price of iron and steel rose 13 percent annually; the price of sand, gravel, and other quarried products rose 7 percent each year; and the price of architectural and structural metals rose at an average annual rate of 6 percent. Finally, owing also in part to the reconstruction effort in the wake of Hurricane Katrina in 2005, the price of cement and concrete rose at a rate of 7 percent per year.

Wages paid to construction workers also increased from 2003 to 2007, although much less rapidly than the prices of materials. For example, the average hourly earnings of

8. For an overview of price trends for highway and road construction, see Department of Transportation, Federal Highway Administration, "Highway Construction Cost Increases and Competition Issues," available at www.fhwa.dot.gov/programadmin/contracts/price.cfm.

production and nonsupervisory employees in highway, street, and bridge construction increased 2.4 percent annually.[9]

The rising cost of highway construction from 2003 to 2007 more than offset an increase in nominal spending on that infrastructure, so that spending in constant dollars fell by an average of 1.6 percent per year (see Figure 3). In particular, the increasing cost to build highways outpaced average annual increases of 6 percent a year in nominal spending on such capital projects.[10] Nominal spending for the construction of several other types of surface transportation and aviation infrastructure, which requires materials similar to those used to build highways, was also outstripped by rising costs. Overall, real capital spending on those types of infrastructure fell by an average of roughly 9 percent annually from 2003 to 2007.

Federal Spending and the American Recovery and Reinvestment Act of 2009

In 2009, the federal government spent $87 billion on transportation and water infrastructure, an increase of $6 billion over the amount spent in 2007. Adjusted for inflation, that spending represented the first annual increase in federal outlays for such infrastructure since 2002. Of those expenditures, about $4 billion was from appropriations contained in the American Recovery and Reinvestment Act of 2009. That amount is small in comparison with the approximately $62 billion in total federal funding that the Congress made available through ARRA for transportation and water infrastructure because it usually takes several years for such projects to be planned and implemented and the rate of spending typically reflects that pace.

According to CBO's estimates, in nominal terms, infrastructure outlays for transportation and water projects under ARRA peaked in 2010 and will remain relatively high in 2011 (see Figure 4 on page 7). CBO expects that cumulative spending for such infrastructure under ARRA will total $54 billion by 2013 and $61 billion by 2020. About three-quarters of nominal outlays through 2013 ($39 billion) will be devoted to surface transportation, CBO anticipates, with $27 billion designated for highways, $8 billion for mass transit, and $3 billion for rail and other projects. Additionally, CBO expects that, through 2013, $6 billion of the funding provided by ARRA will be spent on water resources, $8 billion on water and wastewater treatment, $2 billion on aviation, and $200 million on water transportation.[11]

Most of the $4.4 billion in outlays for transportation and water infrastructure that ARRA funded in 2009 was devoted to capital projects. Of that amount, $2.4 billion was allocated to highways and $1.0 billion to mass transit; all of that funding took the form of grants to state and local governments. The federal government also spent

9. Neither workers' wages nor the cost of other inputs into infrastructure construction (such as the cost of capital) are included in the price indexes that CBO used in its analysis to convert nominal spending on infrastructure capital into real quantities. However, because labor costs do not account for a large part of infrastructure spending—at least for the major types of infrastructure capital considered here—incorporating those more modest price increases would be very unlikely to reverse the conclusion that real public spending on infrastructure capital declined after 2003. For example, total employment in the highway, street, and bridge construction sector was 358,500 in 2007, and average annual wages were $43,900. Thus, total wages in that sector amounted to $15.7 billion, or about 20 percent of all public spending on highway capital projects in that year ($82.2 billion). See Bureau of Labor Statistics, "May 2007 Occupational Employment Statistics, National Industry-Specific Occupational Employment and Wage Estimates, NAICS 237300 (Highway, Street, and Bridge Construction)," available at http://data.bls.gov/cgi-bin/print.pl/oes/2007/may/naics4_237300.htm.

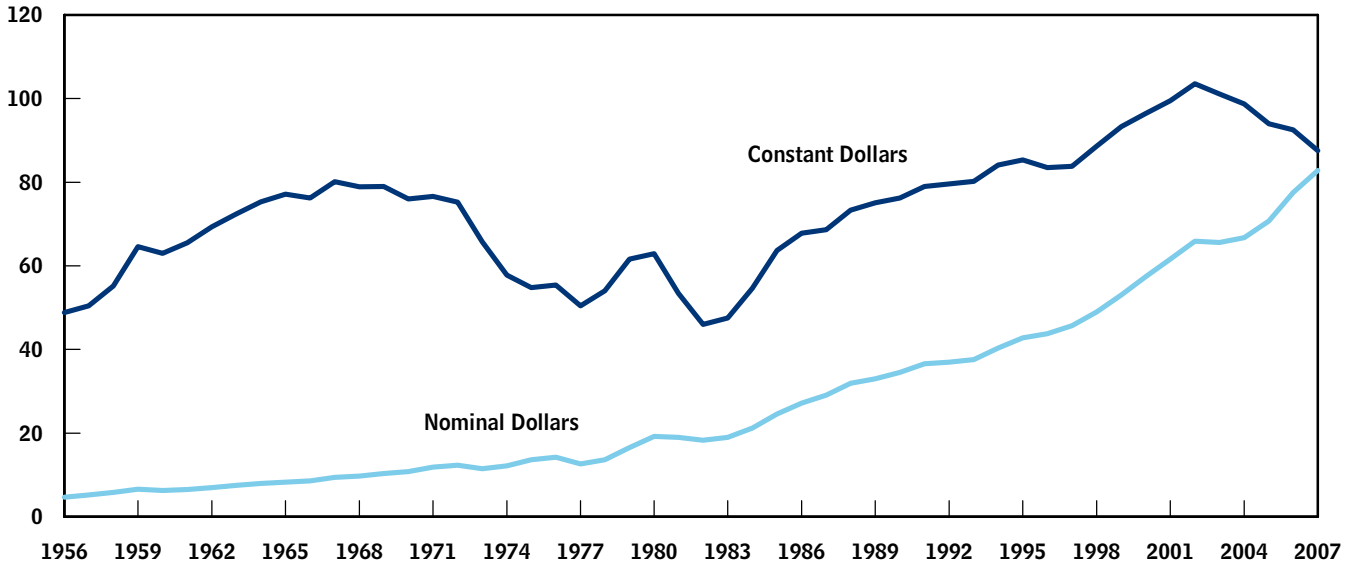
10. As a result of the Safe, Accountable, Flexible, Efficient Transportation Act: A Legacy for Users (enacted as P.L. 109-59), which authorized funding for federal highway and mass transit programs after 2003, the average amount of budgetary resources available from the Highway Trust Fund for highway and mass transit infrastructure projects was almost 60 percent higher between 2005 and 2009 than it was between 1998 and 2003. However, such authorizations do not automatically translate into outlays. States and localities draw on those federal resources to commit to multiyear highway and mass transit projects, on which they make payments over time as the work progresses. The associated federal outlays reimburse state and local governments for those eventual payments; as a result, the amount of outlays made in a given year can differ from the amount of federal funding available to state and local governments in that same year. See the statement of Robert A. Sunshine, Deputy Director, Congressional Budget Office, before the House Committee on the Budget, *Public Spending on Surface Transportation Infrastructure* (October 25, 2007), pp. 7–8 and pp. 10–11.

11. Projected outlays under ARRA may overstate the amount by which that legislation increases infrastructure spending above its normally funded level. The additional funding already provided by ARRA could result in lower appropriations in the future and displace infrastructure expenditures that state and local governments would otherwise have made.

Figure 3.

Total Public Spending for Highway Capital, in Constant and Nominal Dollars, 1956 to 2007

(Billions of 2009 dollars)



Source: Congressional Budget Office.

Notes: Total public spending is the sum of expenditures by the federal government and by state and local governments.

Capital spending includes the purchase, construction, rehabilitation, or improvement of physical assets, such as land, facilities, and equipment.

Spending expressed in constant dollars has been adjusted to reflect the effects of inflation between the year the spending occurred and a base year, which in this study is 2009. Spending expressed in nominal dollars indicates the amount of spending over a given period without an adjustment for inflation.

$0.5 billion for water resources. Most of the remainder went to aviation, rail (Amtrak), and water utilities; in 2009, there were no outlays for high-speed rail or water transportation infrastructure from amounts appropriated by ARRA.

In addition to the funding that ARRA provided, the legislation also authorized expanded federal tax preferences—particularly in the form of Build America Bonds (BABs)—for debt that state and local governments issue to finance infrastructure and other projects (see Box 1 on page 8). State and local governments report that, of the more than $137 billion in proceeds made available through the issuance of BABs between April 2009 and September 2010, they will use almost one-third ($43 billion) for capital spending on transportation and water projects.[12]

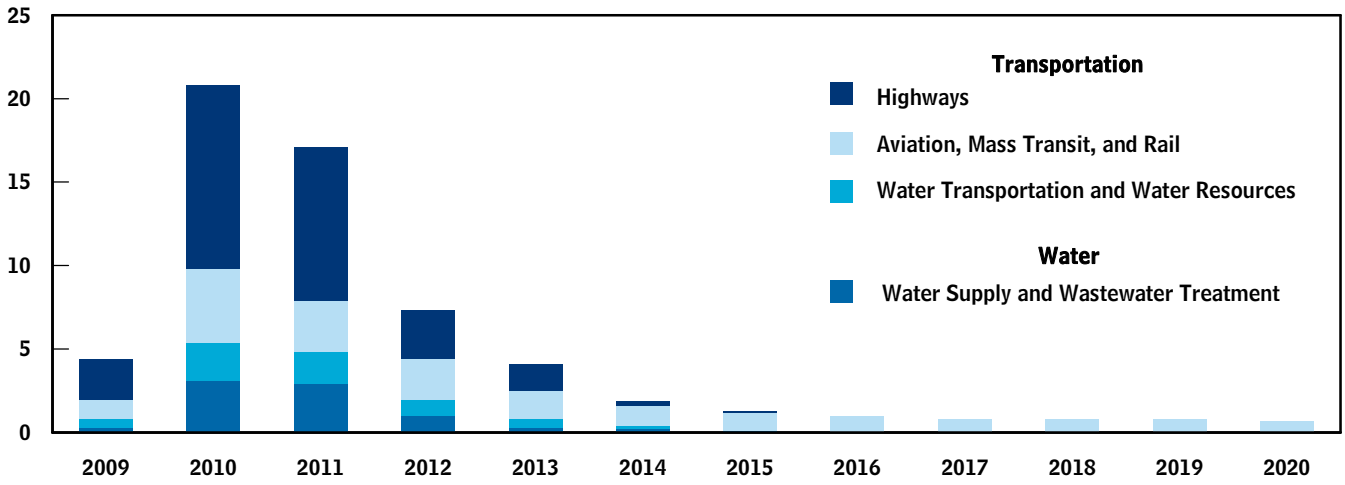
CBO projects that the issuance of BABs in 2009 and 2010 will ultimately result in a federal subsidy to municipal borrowers of about $40 billion (in nominal dollars) through 2020. States and localities will generally respond to the larger federal financing subsidy offered by BABs and issue those bonds instead of conventional tax-exempt debt. In contrast to conventional tax-exempt debt, the interest paid on BABs is taxable. Thus, the $40 billion in federal subsidy payments to issuers of BABs is expected to be partially offset by $28 billion in tax revenues. As a result, the net impact on the federal budget of those issues is expected to be about $12 billion. Making a payment directly to state and local governments to compensate them for the interest they pay on BABs is a more

12. For updated information on Build America Bond issuance by purpose, see Securities Industry and Financial Markets Association, *Build America Bonds Factsheet 2010, Third Quarter*, available at www.sifma.org/research/item.aspx?id=19650.

Figure 4.

Actual and Estimated Spending for Transportation and Water Infrastructure Under the American Recovery and Reinvestment Act, 2009 to 2020

(Billions of nominal dollars)



Source: Congressional Budget Office (August 2010 baseline estimates).

Notes: For the purposes of this analysis, the phrase "transportation and water infrastructure" encompasses the facilities and systems that support transportation, provide water resources, supply drinking water, and treat wastewater.

Spending expressed in nominal dollars indicates the amount of spending over a given period without an adjustment for inflation.

cost-effective way of providing a federal financing subsidy than offering a tax-exemption. Therefore, the reduction in state and local governments' borrowing costs (over what they would have realized by issuing tax-exempt bonds) exceeds the $12 billion additional cost to the federal government.[13]

The Composition of Public Spending on Transportation and Water Infrastructure

About 75 percent of public funding for transportation and water infrastructure is supplied by state and local governments, with the federal government providing the remaining 25 percent. Almost 50 percent of total public funding for such infrastructure is devoted to capital expenditures. From the mid-1980s through the early 2000s, public spending on capital was usually fairly close to that for operation and maintenance. Since that time, however, spending on capital has fallen somewhat below expenditures for operation and maintenance. State and local governments currently account for about 60 percent of public capital spending on transportation and water infrastructure, and they provide almost 90 percent of public spending for operation and maintenance.

Between 1956 and 2007, the largest portion of annual public funding for transportation and water infrastructure was dedicated to highways. Public expenditures on highway capital in 2007 totaled $88 billion, more than twice as much as the next largest amount of capital expenditures that year ($39 billion on water supply and wastewater treatment). Among various types of infrastructure built over the 1956–2007 period, highways also claimed the largest amount of public expenditures for operation and maintenance ($67 billion). However, spending for the operation and maintenance of other forms of transportation infrastructure and for water supply systems and wastewater treatment plants grew at a

13. For a discussion of the greater cost-effectiveness of Build America Bonds (and tax-credit bonds more generally) over tax-exempt debt, see Congressional Budget Office and Joint Committee on Taxation, *Subsidizing Infrastructure Investment with Tax-Preferred Bonds* (October 2009). For an early study estimating the additional savings that state and local governments realized by issuing BABs rather than tax-exempt debt, see Department of the Treasury, *Treasury Analysis of Build America Bonds and Issuer Net Borrowing Cost* (April 2, 2010), available at www.ustreas.gov/offices/economic-policy/4%202%2010%20BABs%20Savings%20Report%20FINAL.pdf.

Box 1.

Tax-Preferred Bonds and Public Spending for Infrastructure

Interest income from most bonds issued by state and local governments is exempt from federal income tax (and, in many cases, from state taxes as well). As a result, state and local governments can borrow at lower rates of interest. The federal revenues forgone through such tax preferences effectively subsidize state and local investment in infrastructure and other projects. Financing infrastructure projects using tax-exempt bonds, however, is generally not considered to be a cost-effective way of transferring revenues from the federal government to states and localities. The savings in interest that states and localities gain through the tax exemption are less than the revenues forgone by the federal government as a result of the tax exemption. That differential arises because the average holder of tax-exempt bonds—who determines the amount of federal revenues forgone through the tax exemption—is typically in a higher tax bracket than the individual who buys the bond that determines the market price for those bonds and, correspondingly, the savings in financing costs for states and localities.

Over the past decade, the Congress has authorized tax-credit bonds as an alternative method for providing tax subsidies.[1] Tax-credit bonds subsidize the issuer's cost of borrowing by providing a tax credit instead of (or in addition to) the payment of interest to the holder of the bond or, in some cases, directly to the issuer. Because each holder of a tax-credit bond pays taxes on the value of that credit at his or her own marginal income tax rate, there is no transfer of federal revenue to bondholders in upper-income tax brackets. Tax-credit bonds thus offer a more cost-effective means of subsidizing borrowing because every dollar of federal revenue forgone through the tax credit is transferred to borrowers rather than accruing in part to individuals whose marginal tax rate is sufficiently high that the amount of interest they receive from tax-exempt bonds exceeds what they would require to be indifferent to holding taxable versus tax-exempt debt. Tax-credit bonds can also be more economically efficient in another way: Because the tax credit can be set at any amount, the federal subsidy can be adjusted to match the expected gains federal taxpayers receive from different infrastructure projects.

The American Recovery and Reinvestment Act of 2009 (ARRA) authorized a new type of tax-preferred

1. The importance of those subsidies to infrastructure investment is discussed in Congressional Budget Office and Joint Committee on Taxation, *Subsidizing Infrastructure Investment with Tax-Preferred Bonds* (October 2009), pp. 17–29 and pp. 31–34. That study also provides additional discussion of the various types of tax-exempt and tax-credit bonds and of their advantages and disadvantages as a means of delivering a federal borrowing subsidy.

Continued

faster rate than spending to operate and maintain highways. As a result, by 2007, public spending for the operation and maintenance of each of those types of infrastructure had reached levels close to those for highways.

Spending by Level of Government

In 2007, state and local governments spent $275 billion on transportation and water infrastructure, and the federal government spent $82 billion (see Figure 5 on page 10). Thus, the federal share of spending for such infrastructure that year was 23 percent. Over the past two decades, federal spending on transportation and water infrastructure as a share of total public spending has ranged from 23 percent to 27 percent (see Table A-2 on page 24).

From 1956 to 2007, public spending for transportation and water infrastructure rose at an average rate of 2.1 percent annually (after adjusting for inflation). Between 1956 and 1977, real federal spending on such infrastructure grew much more rapidly than spending by states and

Box 1. **Continued**

Tax-Preferred Bonds and Public Spending for Infrastructure

bonds, Build America Bonds (BABs), which can be issued by state and local governments in 2009 or 2010 and offer a more generous subsidy of interest costs. There are essentially two types of Build America Bonds: "tax-credit" BABs, for which the bondholder can claim a taxable credit equal to 35 percent of the coupon payment on the bond; and "direct-pay" BABs, for which the federal government makes a subsidy payment directly to bond issuers equal to 35 percent of the coupon on the bond. Most of the BABs issued to date have been of the direct-pay variety. Direct-pay BABs provide issuers with a larger interest subsidy because holders of those bonds do not pay tax on the value of the credit and thus do not require compensation for any tax. However, some conditions must be met for a Build America Bond to qualify as a "direct-pay" issue: in particular, all of the proceeds (net of issuance costs) must be used for capital spending.

The popularity of Build America Bonds has prompted several initiatives to expand tax-credit financing at the federal level. For example, the President's budget for fiscal year 2011 proposes to make BABs permanent at a 28 percent credit rate and allow them to be issued by nonprofits—organizations such as schools and hospitals, as defined in section 501(c)(3) of the Internal Revenue Code—and for the additional purposes of refunding existing debt and financing working capital.[/] That proposal would thus configure BABs as a more complete replacement for traditional tax-exempt debt. The proposal in the President's budget to make BABs permanent is echoed by the Bipartisan Tax Fairness and Simplification Act of 2010 (S. 3018), which would replace the federal tax exemption on state and local bond interest income for bondholders other than corporations with a tax credit equal to 25 percent of bond interest. Other legislative initiatives in the 111th Congress would authorize Build America Bonds for only a limited time. In the Investing in American Jobs and Closing Tax Loopholes Act, H.R. 5893, the Congress would authorize BAB issuance through 2012 and reduce the interest rate subsidy to 32 percent for bonds sold in 2011 and to 30 percent for bonds sold in 2012. S. 3793 would authorize BAB issuance through 2011 and reduce the subsidy rate for bonds issued in that year to 32 percent. As of the publication of this study, S. 3018, H.R. 5893, and S. 3793 had not been approved by the Congress.

/† Section 501(c)(3) of the Internal Revenue Code defines a qualified nonprofit as any entity "organized and operated exclusively for religious, charitable, scientific, testing for public safety, literary, or educational purposes, or to foster national or international amateur sports competition . . . or for the prevention of cruelty to children or animals." A nonprofit may not engage in political activity, and none of its earnings may benefit any private shareholder or individual.

localities (with average annual rates of growth of 7 percent and 1 percent, respectively). During the next decade, however, state and local spending grew at an average annual rate of about 5 percent, and federal spending declined by an average of just over 1 percent each year. Between 1987 and 2003, the average rate of real annual growth in the federal government's spending for transportation and water infrastructure equaled that of state and local governments—2.3 percent. From 2003 to 2007, federal spending dropped by 4.7 percent annually, whereas state and local spending declined by 0.5 percent each year.

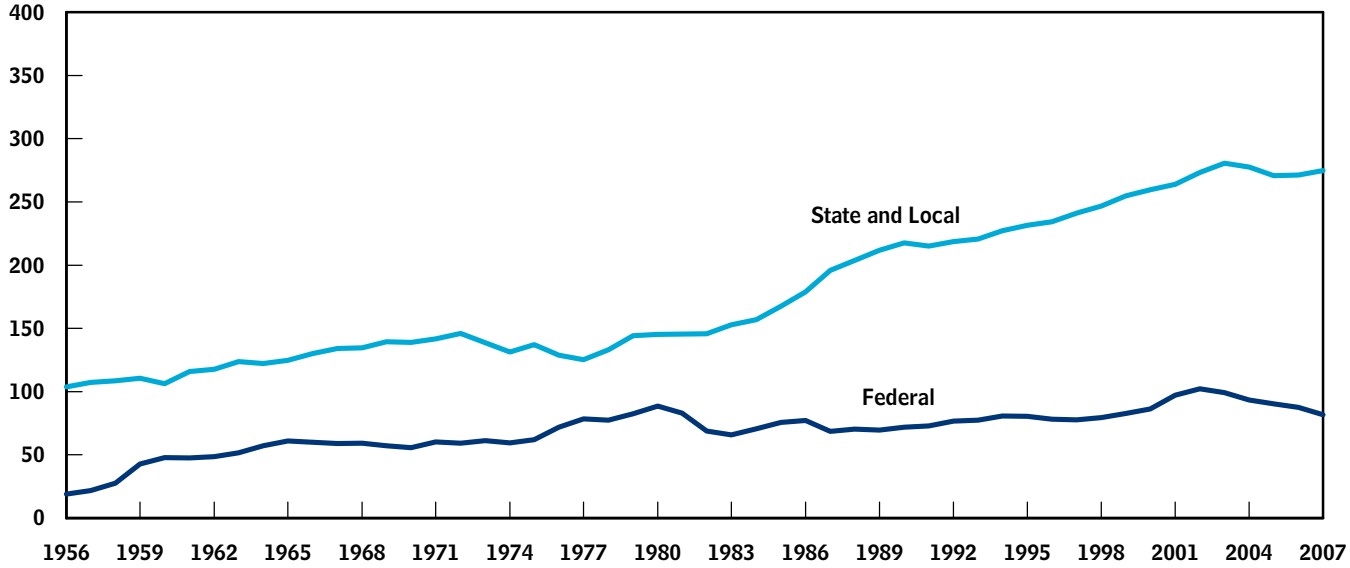
Spending for Capital and for Operation and Maintenance

In 2007, real capital expenditures for transportation and water infrastructure totaled $161 billion; spending that year for operation and maintenance amounted to $196 billion (see Table A-3 on page 26). From 1956 through the early 1970s, public spending on capital projects was considerably greater than spending for operation and maintenance as the federal government began constructing the interstate highway system and increased spending on other types of infrastructure (see Figure 6 on page 12).

Figure 5.

Public Spending for Transportation and Water Infrastructure, by Level of Government, 1956 to 2007

(Billions of 2009 dollars)



Source: Congressional Budget Office.

Notes: For the purposes of this analysis, the phrase "transportation and water infrastructure" encompasses the facilities and systems that support transportation, provide water resources, supply drinking water, and treat wastewater.

Spending expressed in constant dollars has been adjusted to reflect the effects of inflation between the year the spending occurred and a base year, which in this study is 2009.

Over the next two decades, capital expenditures for transportation and water infrastructure were either equal to or slightly below public spending for operating and maintaining that infrastructure. (A dip in capital spending during the early 1980s briefly caused that gap to widen markedly.) After 2003, real public spending on capital fell for several years in a row; by 2007, those expenditures were $35 billion less than spending for operation and maintenance (although capital expenditures still accounted for 45 percent of total spending).

Spending for Capital. In 2007, state and local governments spent $103 billion on transportation and water infrastructure capital; the federal government spent $58 billion (see Figure 7 on page 13 and Table A-4 on page 28). State and local governments thus accounted for over 60 percent of public capital spending on such infrastructure, and the federal government accounted for just under 40 percent—shares that have been quite stable over the past two decades. More than 80 percent of federal capital outlays for transportation and water infrastructure took the form of grants and loan subsidies—which offer below-market interest rates or have the same effect as loan guarantees—to state and local governments (see Table A-5 on page 30).[14]

The federal government's capital spending on transportation and water infrastructure posted a much steeper decline between 2003 and 2007 than did capital expenditures by state and local governments. Two developments in particular contributed to that outcome. First, in nominal terms, the federal government increased its spending on highways each year at a much slower rate (about 3 percent per year) than did state and local governments (about 8 percent per year). Because the costs of procuring highways rose at an average annual rate of 10 percent, real federal investment in highways declined at an annual rate of 6 percent as compared with 1.5 percent at the state and local level.

There is a second reason that federal outlays for infrastructure capital fell more sharply from 2003 to 2007

than did state and local capital spending: Patterns of spending for water supply and wastewater treatment facilities differed. In inflation-adjusted terms, investment by state and local governments in water utilities rose by 3 percent annually while federal expenditures over the same period declined by 13 percent. During that period, spending on water and wastewater treatment accounted for more than 30 percent of capital expenditures by state and local governments for transportation and water infrastructure but only about 5 percent of such spending at the federal level.

Spending for Operation and Maintenance. Nearly all public spending for operating and maintaining transportation and water infrastructure takes place at the state and local level. Whereas state and local governments spent $172 billion for the operation and maintenance of infrastructure in 2007, the federal government spent just $24 billion. States and localities supplied almost 90 cents of every public dollar allocated for operating and maintaining facilities related to transportation and water infrastructure. States and localities have been the primary source of that spending for the past 50 years (see Figure 8 on page 14 and Table A-6 on page 32). However, the federal government does play a large role in funding the operation and maintenance of one component of transportation and water infrastructure: the nation's air traffic control system. The federal government spent roughly $7 billion (in nominal dollars) to operate that system in 2007, a figure that represented one-third of total public spending on the operation and maintenance of aviation infrastructure that year.

Spending by Type of Infrastructure

Highways claim by far the largest amount of total public spending on transportation and water infrastructure and have done so for years (see Figure 9 on page 15). In constant dollars, spending on highways reached $155 billion in 2007, which represents 43 percent of all public spending for such infrastructure (see Table A-7 on page 34). Expenditures for water supply and wastewater treatment systems amounted to $101 billion in 2007 (which accounted for about 28 percent of total public spending for infrastructure), followed fairly closely by spending for aviation, mass transit, and rail at $84 billion (which accounted for 23 percent of total spending). Public spending on water transportation and water resources that year was $17 billion (which represents 5 percent of total spending).

With the exception of outlays for water transportation and water resources, real public spending on most broad categories of transportation and water infrastructure has tended to increase over time. However, depending on the type of infrastructure, capital expenditures have tended to fluctuate (see Figure 10 on page 16 and Table A-8 on page 36). For example, the construction of the interstate highway system caused real capital spending on highways to grow rapidly in the late 1950s and early 1960s, reaching a plateau that lasted through the early 1970s. Following a sharp drop-off in the mid-1970s, real spending on highways fluctuated for about a decade before resuming a pattern of fairly steady growth through the early 2000s, when the previously discussed decline occurred.

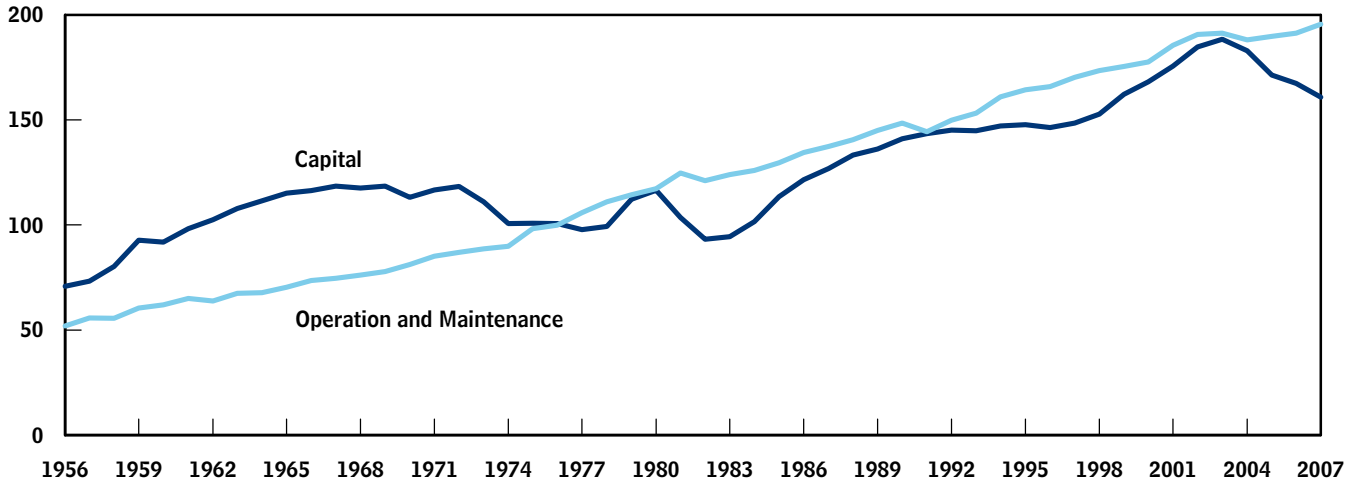
By 2007, the amounts spent to operate and maintain other types of transportation and water infrastructure—water supply systems and wastewater treatment plants, and the facilities and equipment that support aviation, mass transit, and rail—had almost reached the levels spent to operate and maintain highways (see Figure 11 on page 17 and Table A-9 on page 38). Expenditures for water transportation and water resources are the exception: Public spending for the operation and maintenance

14. Federal grants typically take the form of payments that reimburse state and local governments for certain expenses they incur. Federal credit subsidies result under the following circumstances: when the government makes loans at rates of interest that do not sufficiently compensate for the default risk posed by borrowers, or when the government incurs financial liability by guaranteeing the loans of borrowers who might default. Credit subsidies are calculated under the Federal Credit Reform Act of 1990 (FCRA), which requires that when federal loan or loan-guarantee programs are established or modified, funds must be appropriated to cover the credit subsidy that the government provides through those loans and credit guarantees (P.L. 101-508; 104 Stat. 1388-613). FCRA defines the subsidy amount—which counts as a federal outlay—as the present discounted value of expected net outlays from the federal government. The present discounted value is a single number that expresses a flow of current and future income (or payments) in terms of an equivalent lump sum received (or paid) today. The net present value depends on future cash flows and the interest rates used to translate each future cash flow into current dollars. The interest rates used to estimate a federal credit subsidy are specified by the Office of Management and Budget as the interest on a U.S. Treasury security with a payoff date that corresponds to the date of an expected future outlay. Those Treasury interest rates do not reflect the cost of risk associated with infrastructure investments that private investors would require compensation to bear. Hence, the subsidy recorded in the budget under FCRA is less than the full economic cost of federal credit assistance.

Figure 6.

Total Public Spending for Transportation and Water Infrastructure: Expenditures for Capital and Related Operation and Maintenance, 1956 to 2007

(Billions of 2009 dollars)



Source: Congressional Budget Office.

Notes: Total public spending is the sum of expenditures by the federal government and by state and local governments.

For the purposes of this analysis, the phrase "transportation and water infrastructure" encompasses the facilities and systems that support transportation, provide water resources, supply drinking water, and treat wastewater.

Capital spending includes the purchase, construction, rehabilitation, or improvement of physical assets, such as land, facilities, and equipment. The remaining portion of public expenditures consists of noncapital outlays—primarily for the operation and maintenance of physical assets. When calculating spending for operation and maintenance, CBO also includes spending on investment in intangible assets (for instance, for research and development), as well as expenditures for administrative activities and public outreach (such as educational and safety programs).

Spending expressed in constant dollars has been adjusted to reflect the effects of inflation between the year the spending occurred and a base year, which in this study is 2009.

of those forms of infrastructure has been flat, on balance, over the entire 1956–2007 period. However, since 1991, the trend in public spending for water resources has been difficult to interpret from government statistics because, from that year onward, state and local governments have included data on their spending for that infrastructure in a broader category of natural resources that encompasses activities not considered in this study to be related to infrastructure. Consequently, spending by states and localities on water resources is not reported here.

The Role of Government in Funding Transportation and Water Infrastructure

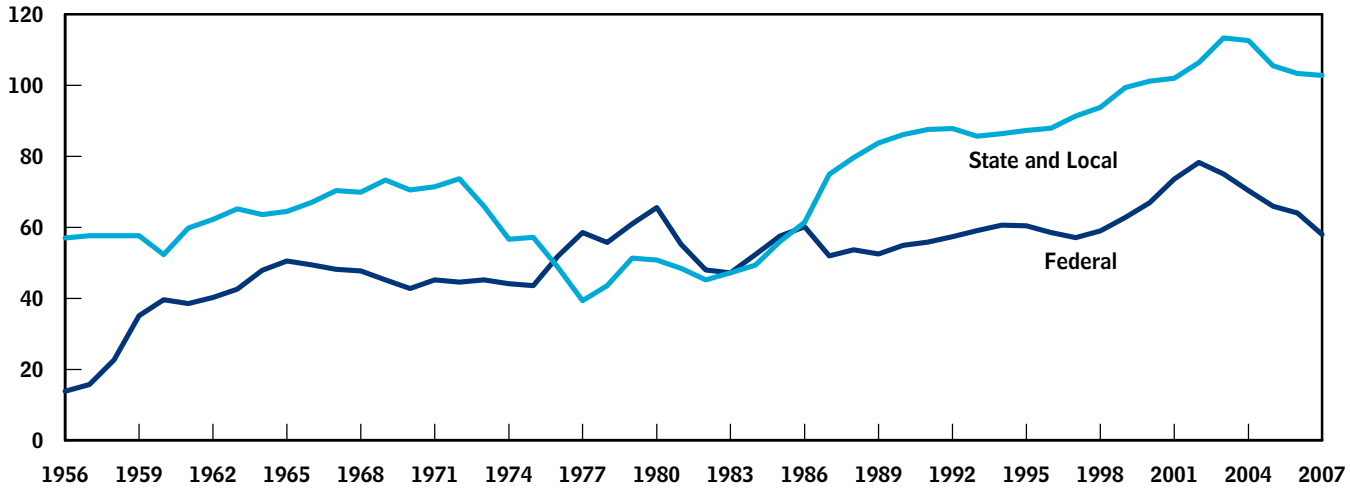
In the United States, transportation and water infrastructure is provided primarily by the public sector and paid for by taxpayers and users. Although such infrastructure projects may be built or operated and maintained by private firms on behalf of the public sector, the federal government and state and local governments typically determine which projects to undertake and how much to spend on them.

The public sector acts as a principal provider of transportation and water infrastructure for several reasons. First, such infrastructure and the services associated with it display, at least to some degree, important characteristics of public goods: Specifically, it can be difficult and costly to exclude consumers from using that infrastructure, or to charge them for using it, once it is in place; and its use by one consumer may not alter the benefits it can provide to another consumer. For example, although toll roads have been in existence on a limited basis for years, controlling access to, and charging for the use of, highways and roads generally has been challenging. (Such obstacles may

Figure 7.

Public Spending for Transportation and Water Infrastructure Capital, by Level of Government, 1956 to 2007

(Billions of 2009 dollars)



Source: Congressional Budget Office.

Notes: For the purposes of this analysis, the phrase "transportation and water infrastructure" encompasses the facilities and systems that support transportation, provide water resources, supply drinking water, and treat wastewater.

Capital spending includes the purchase, construction, rehabilitation, or improvement of physical assets, such as land, facilities, and equipment.

Spending expressed in constant dollars has been adjusted to reflect the effects of inflation between the year the spending occurred and a base year, which in this study is 2009.

diminish in the future, however, as technological advances allow tolls to be used on a more widespread basis to pay for highways and roads.) Similarly, dams and other natural resource projects can provide various benefits, such as flood control and recreation, to a wide range of consumers, making it hard to know whom to charge, and how much, for those services. Moreover, where those services can be provided to an additional consumer at no extra cost—an additional home in an area protected by a dam, for example—there is a rationale for charging nothing at all.

Second, even if it was possible to completely control access to infrastructure and to charge individuals a fee commensurate with the benefits they obtain from using such services, the existence of benefits (or costs) that extended beyond the direct use of infrastructure could provide a rationale for the government to provide or regulate that infrastructure. An example of the broad social benefits that might warrant the public sector's funding of infrastructure is the benefit, from a public-health perspective, of having widespread access to potable water, which water supply systems and wastewater treatment plants make possible.

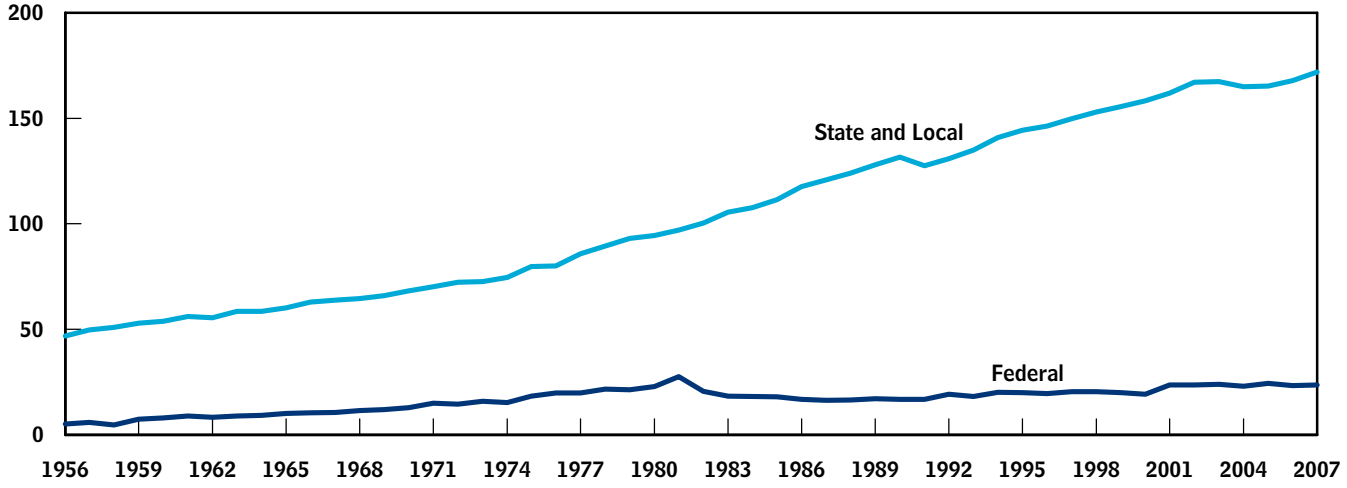
Finally, reinforcing the rationale for public provision is the fact that transportation and water infrastructure often constitutes what is known as a natural monopoly: Building such infrastructure imposes high up-front costs but requires low incremental costs to operate and maintain, making it economically feasible for only one entity to undertake such projects. As a consequence, public ownership—or at least public oversight—could be necessary to maintain the supply of such services at or near an economically efficient level and to keep the price no higher than what is required to cover the cost of supplying the services. By contrast, a private firm in such a position would be expected to try to maximize profits by restricting supply and raising prices.

Those reasons for public provision leave open two questions: How much infrastructure should the public sector provide? And, of that infrastructure, how much should the federal government provide?

Figure 8.

Public Spending for the Operation and Maintenance of Transportation and Water Infrastructure, by Level of Government, 1956 to 2007

(Billions of 2009 dollars)



Source: Congressional Budget Office.

Notes: For the purposes of this analysis, the phrase "transportation and water infrastructure" encompasses the facilities and systems that support transportation, provide water resources, supply drinking water, and treat wastewater.

When calculating spending for operation and maintenance, which pertains primarily to physical assets, CBO also includes spending on investment in intangible assets (for instance, for research and development), as well as expenditures for administrative activities and public outreach (such as educational and safety programs).

Spending expressed in constant dollars has been adjusted to reflect the effects of inflation between the year the spending occurred and a base year, which in this study is 2009.

Deciding How Much the Public Sector Should Spend

Deciding how much the public sector should spend on infrastructure involves assessing the benefits and costs to society of that spending, as well as the distribution of those costs and benefits. Some benefits may be observable and measurable in indicators such as private-sector productivity or gross domestic product; other benefits may be difficult or impossible to measure. Moreover, concerns about equitable distribution may lead policymakers to pursue the goal of providing all citizens access to certain types of infrastructure—for example, air transportation services in small communities. (In addition, infrastructure spending can boost demand for goods and services during an economic downturn, helping mitigate temporary losses in output and employment; see Box 2 on page 18.)

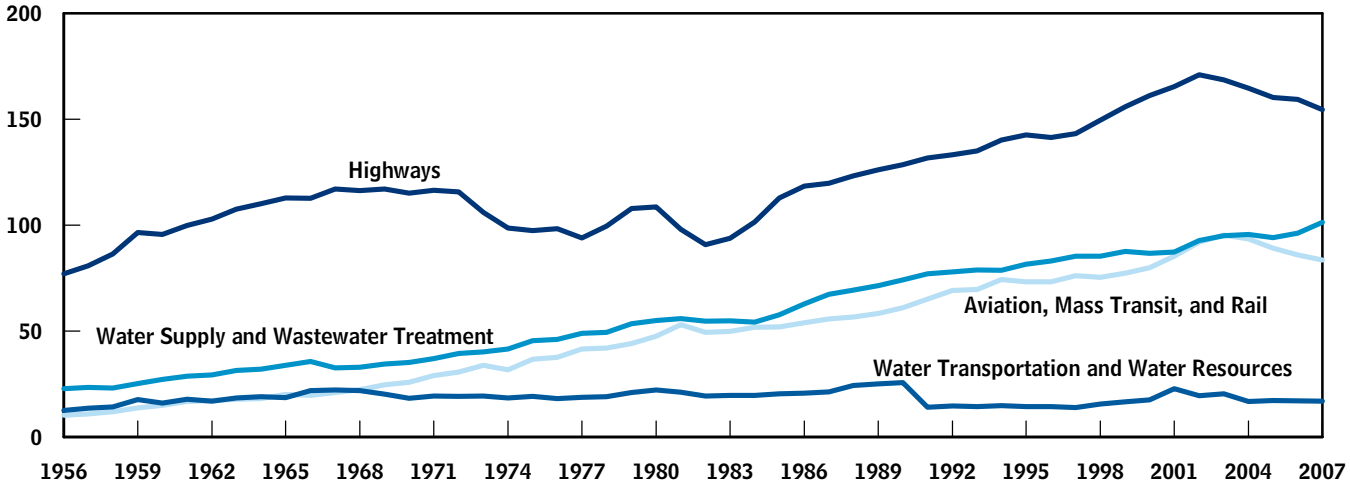
The Effect of Spending on Productivity and Output. Public investment in infrastructure can increase economic output by raising the stock of capital in the economy, thereby increasing the productivity of labor. Increasing the amount of transportation infrastructure, for example, makes it easier to get materials and labor to production facilities and finished goods to consumers. Consequently, workers can produce and deliver more in a given time and at a given transport cost. A more productive national economy results in more goods and services for citizens and more resources for further investment and continued growth.

CBO's review of the literature on the returns provided by infrastructure spending supports two main conclusions. First, in the United States, investment in public capital projects generally yields returns that are positive; the estimated returns, however, are much smaller than the returns reported in some previous research. Second, there is significant variation in the average return across different periods of time and in returns across individual projects at a given point in time.

Figure 9.

Total Public Spending for Transportation and Water Infrastructure, by Type of Infrastructure, 1956 to 2007

(Billions of 2009 dollars)



Source: Congressional Budget Office.

Notes: Total public spending is the sum of expenditures by the federal government and by state and local governments.

For the purposes of this analysis, the phrase "transportation and water infrastructure" encompasses the facilities and systems that support transportation, provide water resources, supply drinking water, and treat wastewater.

Spending expressed in constant dollars has been adjusted to reflect the effects of inflation between the year the spending occurred and a base year, which in this study is 2009.

Data on public spending for water transportation and water resources after 1990 do not include expenditures by states and localities on water resources.

For example, the payoff from investing in highways appears to have fallen significantly over time. According to data spanning 1953 to 1989, construction of the interstate highway system between 1953 and 1973 made vehicle-intensive industries in particular more productive; however, the capital spending that took place after that system was largely completed in 1973 seems to have had little further effect on productivity.[15]

Economically Justifiable Investment in Infrastructure. In research that assesses the impact of public spending on infrastructure, analysts typically use one of two criteria to determine the desirability of providing additional public funding for such purposes. Some analyses emphasize the technical features of the infrastructure in question—say, the thickness of highway pavement, the load-carrying capacity of bridges, or the purity of drinking water—and whether those features meet a desired engineering or public-health standard. Other studies take a more economically oriented approach and attempt to assess whether the value of any resulting benefits, when quantified in dollars, would at least match the additional expenditures required. Those benefits would be measured in terms of the value of improved infrastructure, such as reduced congestion or the public health benefits that result from widespread access to potable water.

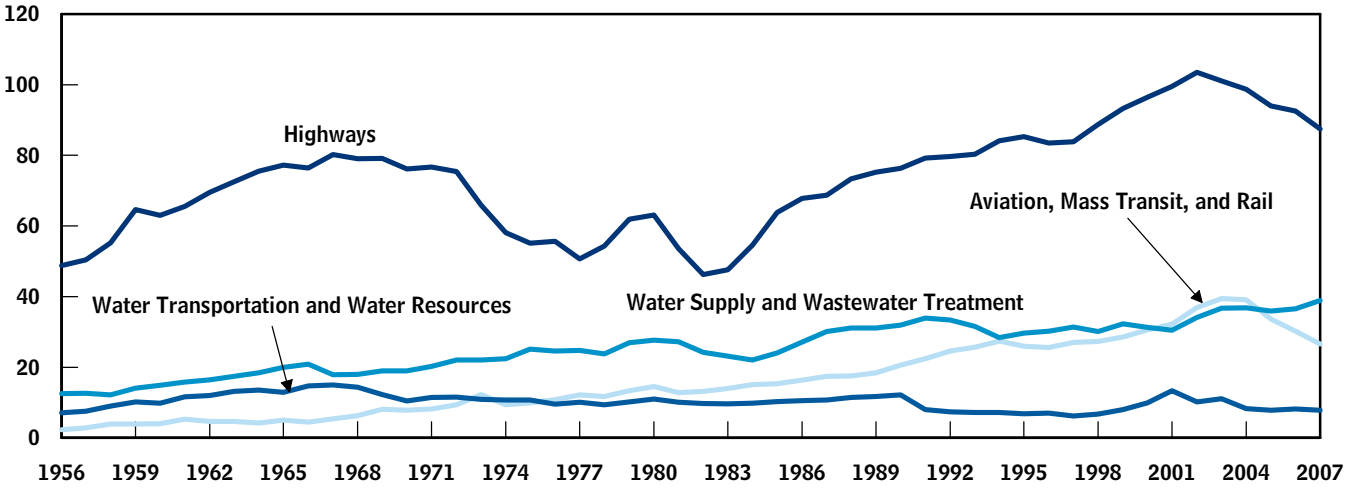
In a review in 2008 of studies that assess infrastructure spending in the United States, CBO evaluated estimates from the Federal Highway Administration (FHWA) and other public and private organizations. Those estimates

15. See John G. Fernald, "Roads to Prosperity," *American Economic Review*, vol. 89, no. 3 (June 1999), pp. 619–638.

Figure 10.

Total Public Spending for Transportation and Water Infrastructure Capital, by Type of Infrastructure, 1956 to 2007

(Billions of 2009 dollars)



Source: Congressional Budget Office.

Notes: Total public spending is the sum of expenditures by the federal government and by state and local governments.

For the purposes of this analysis, the phrase "transportation and water infrastructure" encompasses the facilities and systems that support transportation, provide water resources, supply drinking water, and treat wastewater.

Capital spending includes the purchase, construction, rehabilitation, or improvement of physical assets, such as land, facilities, and equipment.

Spending expressed in constant dollars has been adjusted to reflect the effects of inflation between the year the spending occurred and a base year, which in this study is 2009.

Data on public spending for water transportation and water resources after 1990 do not include expenditures by states and localities on water resources.

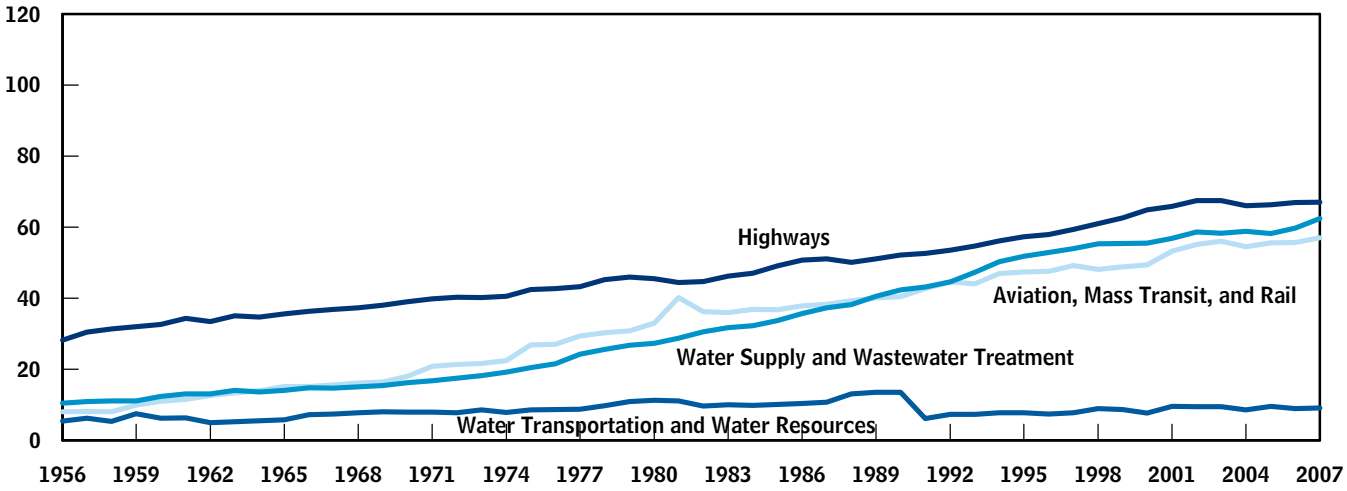
indicate that tens of billions of dollars of additional spending per year on transportation infrastructure would be required to maintain current levels of service. Moreover, an even larger amount of spending could be justified on a cost–benefit basis, particularly for highways, to expand capacity and improve performance. (Performance would be gauged, for instance, by the effects of congestion on travel time.) For example, the FHWA estimated that, without significant changes in the way highways are funded, it would cost $126 billion in constant dollars each year to maintain performance—$33 billion more than the $93 billion spent in 2006. Further, the FHWA estimated that the amount of public spending that could be justified on the basis of comparing costs and benefits would be about $208 billion in constant dollars, or more than double the amount spent in 2006. Similarly, CBO analyzed investment in water supply and wastewater treatment infrastructure on the basis of estimates from the Environmental Protection Agency (EPA) and other sources. CBO found that, in constant dollars, roughly $36 billion to $60 billion of capital expenditures would be needed annually between 2000 and 2019 to maintain current service standards and allow some modest improvements to meet current or future regulations imposed by the EPA. By comparison, actual public investment in water utilities and water supply and wastewater treatment systems in 2007 was about $39 billion in constant dollars.[16]

16. See Congressional Budget Office, *Future Investment in Drinking Water and Wastewater Infrastructure* (November 2002). CBO has adjusted those estimates for inflation using price indexes published by the Bureau of Economic Analysis for state and local investment in new water and new sewer structures. See Bureau of Economic Analysis, National Economic Accounts, Section 5: Saving and Investment Tables, 5.8.4A and 5.8.4B, "Price Indexes for Gross Government Fixed Investment by Type," available at www.bea.gov/national/nipaweb/SelectTable.asp?Selected=N#S5.

Figure 11.

Total Public Spending for the Operation and Maintenance of Transportation and Water Infrastructure, by Type of Infrastructure, 1956 to 2007

(Billions of 2009 dollars)



Source: Congressional Budget Office.

Notes: Total public spending is the sum of expenditures by the federal government and by state and local governments.

For the purposes of this analysis, the phrase "transportation and water infrastructure" encompasses the facilities and systems that support transportation, provide water resources, supply drinking water, and treat wastewater.

When calculating spending for operation and maintenance, which pertains primarily to physical assets, CBO also includes spending on investment in intangible assets (for instance, for research and development), as well as expenditures for administrative activities and public outreach (such as educational and safety programs).

Spending expressed in constant dollars has been adjusted to reflect the effects of inflation between the year the spending occurred and a base year, which in this study is 2009.

Data on public spending for water transportation and water resources after 1990 do not include expenditures by states and localities on water resources.

The literature on economic returns on infrastructure spending implies that the ratio of benefits to costs for economically justifiable projects varies widely from project to project. For example, the benefits arising from some projects would probably greatly exceed their costs, whereas the benefits from others would probably just barely do so (and might not exceed the benefits available from other types of federal or private spending). Carefully ranking and funding projects so that only those with the highest net benefits were implemented could yield a large share of the total possible benefits at a fraction of the cost.[17]

In addition, the estimates of economically justifiable spending would be considerably lower if the amount of infrastructure provided accounted for its economic cost, which could be accomplished by charging for its use when that was feasible. For example, the Federal Highway Administration has estimated that widespread use of congestion pricing—which would result in motorists' paying higher fees to drive on a given road during peak hours and lower fees during off-peak hours—would reduce by almost $41 billion and $52 billion, respectively, previous estimates of the annual investment required to maintain services at current levels and to undertake all economically justifiable investments. That is because some motorists would respond to the higher prices for accessing a road during peak travel periods by driving when it is less crowded (and travel is cheaper), by finding alternative routes, or by switching to public transit. A similar argument applies to the use of airspace

17. See Congressional Budget Office, *Issues and Options in Infrastructure Investment* (May 2008). For related discussions, see Congressional Budget Office, *The Economic Effects of Federal Spending on Infrastructure and Other Investments* (June 1998) and *How Federal Spending for Infrastructure and Other Public Investments Affects the Economy* (July 1991).

Box 2.

The Short-Run Effects of Infrastructure Spending on Output and Employment

Infrastructure spending involves direct purchases of goods and services and the hiring of workers, which, in some circumstances, can increase total output and employment in the economy. Spending by the federal government is more likely to contribute to higher output and employment when productive resources in the economy are idle. Under those conditions, public funding for infrastructure projects can lead to the hiring of otherwise unemployed workers who, as a result of the income they receive, create demand for additional goods and services. In contrast, a substantial increase in public spending that occurs when the use of labor and other resources is at a high level will tend to bid up the cost of labor and drive up interest rates. In that scenario, government-funded projects would crowd out private-sector purchases, offsetting some or all of the direct effect of higher government spending on output and employment.

The timing of federal outlays in relation to periods of economic weakness is therefore an important determinant of the effects such outlays will have on total output and employment. Once funding has become available, infrastructure outlays are usually made over the course of the following several years. Some projects, such as highway repair and resurfacing, can be implemented relatively quickly. However, many public infrastructure projects require coordination among different levels of government and the private sector and, as a result, take longer to implement. For instance, large-scale construction projects generally require years of planning and preparation; examples include building new transportation infrastructure that requires establishing rights-of-way and developing and implementing alternative energy sources.[1]

1. For further discussion see Congressional Budget Office, *Policies for Increasing Economic Growth and Employment in 2010 and 2011* (January 2010).

and landing slots at major airports and to other types of infrastructure.[18]

Several other factors should also be considered when interpreting findings about economically justifiable investment in infrastructure. First, assessing the amount of capital spending needed to maintain the performance of established infrastructure is easier than estimating the amount of spending necessary to expand and improve those facilities and determining whether that spending is warranted. Most estimates pertaining to the latter issue are approximations made on the basis of analyses of broad samples of generic projects rather than detailed analyses of individual projects. Moreover, such estimates are often quite sensitive to various assumptions. For example, the value of future benefits must be adjusted with an appropriate discount rate, which represents the cost of elapsed time between an investment and the subsequent benefits received from it, as well as the uncertainty of receiving benefits deferred to the future; a range of parameters could arguably be chosen as the discount rate.

A second consideration is that analyses generating estimates of economically justifiable infrastructure investment typically make no allowance for the opportunity costs associated with public spending, either in terms of the inefficiency those expenditures could introduce in private-sector economic outcomes or in terms of the benefits of using those same funds for other types of public spending. When taxes on income are used to fund public spending for any purpose, consumers' decisions about how much to work may be distorted because taxes on income can reduce the incentive to work. Similarly,

18. For a comprehensive discussion of the benefits and challenges of congestion pricing, including options for its design and implementation for highways, see Congressional Budget Office, *Using Pricing to Reduce Traffic Congestion* (March 2009). Examples of alternative pricing regimens for other types of infrastructure are provided in the *Economic Report of the President* (2008), "Chapter 6: The Nation's Infrastructure," pp. 137–162.

when the government raises revenues through borrowing, it can crowd out some private-sector investment and thereby reduce economic growth. The benefits of the government's investments in infrastructure (and spending in other areas) should be evaluated in light of those potential costs. In addition, the government might undertake other activities that would have equal, or higher, payoffs. Thus, the returns from spending on infrastructure should be weighed against the benefits forgone from not spending on other things.

A third consideration when evaluating estimates of economically justifiable infrastructure investment is the degree to which those findings take into account potential indirect effects of providing that infrastructure. For example, although certain investments in highways and roads might appear economically justifiable because they lower the cost of transporting passengers and products by more than those highways and roads cost to build and maintain, several developments could combine to diminish those net benefits, at least over time. When additional highways and roads are supplied, traffic might simply increase; as a result, growing congestion could eventually counteract the initial gains in travel time resulting from the new construction. Similarly, encouraging more driving by providing more highways and roads could lead to greater vehicle emissions of air pollutants such as carbon dioxide, a greenhouse gas that has been linked to global warming. Many studies find that global warming could have wide-ranging effects on the environment, which could impose significant costs on the economy and, more broadly, on society.[19]

Determining the Role of the Federal Government and of State and Local Governments

In terms of economic efficiency, whether the federal government or state and local governments should fund certain infrastructure projects depends upon whether that funding benefits the nation as a whole or particular states and localities. If those who benefit from a project do not bear its costs, too large a project (or too many projects) might be undertaken or too many infrastructure services consumed relative to the resources used to provide the project or services. To avoid that problem, the federal government could choose to fund a project undertaken by a particular state or locality only if that funding was expected to generate benefits for taxpayers nationwide. Under that scenario, projects that produced benefits only for the citizens of a given state or locality would be funded at those levels of government. Notwithstanding that argument, the federal government might provide funding for infrastructure that offered only local benefits as a way to address other policy goals, such as guaranteeing that all citizens have equal access to a certain type of facility.

Even if the distinction between the federal government's role in funding infrastructure and that of states and localities seems fairly clear in principle, determining how broadly a project provides benefits can be challenging in practice. Whereas it is reasonable to expect that almost all of the benefits resulting from public expenditures on city streets would accrue to the communities served by such infrastructure, the benefits arising from investment in interstate highways could be less locality based and, instead, be distributed regionally or nationally. For example, a highway or airport provides services not just to those who live nearby, but also to those in transit to other places. Consequently, it can be difficult to determine how much of the benefit from highways and roads accrues to local drivers and how much accrues to other motorists.

The challenge of deciding what constitutes an economically efficient level of federal funding for infrastructure that offers a mix of local and national benefits is also reflected in the difficulty of determining how much federal funding would produce benefits that accrued at the national level. Ideally, the amount of federal support would be tailored to specific projects and reflect the desirability of making those investments from a national perspective. However, the federal share of funding for many infrastructure projects usually does not vary among individual projects. For example, states have broad flexibility in deciding how to use the grants they receive under the federal highway program. As long as those highway projects qualify for federal funding, and as long as state governments pay for a portion—typically 20 percent—of the costs, states can decide which projects to carry out and how to do so.

Research has shown that, for highways that are potentially eligible for federal grants, the share of total spending borne by state and local governments is considerably larger than the 20 percent match required for most

19. See Congressional Budget Office, *Potential Impacts of Climate Change in the United States* (May 2009).

projects.[20] That pattern of spending, as well as additional analysis of highway spending by the respective levels of government over time, suggests that federal spending on highways may have displaced some funding that states and localities (which receive some financial assistance for highway projects from their respective state governments) would have provided in the absence of federal involvement. Effectively, although the 80 percent contribution by the federal government could be required to induce state and local spending on some projects that generate benefits at the national level, in general, that contribution could be higher than necessary to foster recent levels of public spending on highways. Raising the matching rate required of state governments above 20 percent would reduce the ability of state and local governments to substitute federal grants for their own funding and thereby divert to other uses some expenditures they otherwise would have made on highways.

The amount of funding that the federal government provides for infrastructure depends not only on matching grants but also on the value of tax preferences provided to states and localities in the form of tax-exempt and tax-credit bonds (see the discussion in Box 1 on page 8). Those tax preferences reduce the financing costs that state and local governments incur when they invest in infrastructure. The amount that those governments receive depends on the types of tax-preferred bonds the Congress allows for specific purposes and on the amount of the subsidy provided by those bonds. In particular, the amount of subsidy that state and local borrowers receive by issuing tax-exempt bonds is largely determined indirectly by the federal tax code. (The degree of progressivity of the federal income tax is an important determinant of the demand for those bonds and, consequently, the interest rates that state and local borrowers must pay.) The effectiveness of federal support for infrastructure could be increased by substituting tax-exempt bonds with tax-credit bonds. Such a policy change would allow the amount of federal subsidy to be determined independently of other federal policy decisions and deliver subsidies of any amount in a more economically efficient manner than would tax-exempt bonds. ◆

20. For a more detailed discussion of the role of federal grants in state and local highway spending, and for additional analysis that supports this conclusion, see Government Accountability Office, *Federal-Aid Highways: Trends, Effects on State Spending, and Options for Future Program Design*, GAO-04-802 (August 2004). Another factor that undermines the efficiency of federal funding is the formulaic approach commonly used to divide federal resources among the states, which can be an obstacle to the funding of projects with the best benefit–cost ratios.

APPENDIX

A

Detailed Data on Spending for Transportation and Water Infrastructure

The tables in this appendix provide the amounts spent annually for transportation and water infrastructure and serve as the basis for the figures that appear in the text. In addition to the tables in Appendix A, a Web supplement to this paper provides greater detail on spending. ◆

Table A-1.

Total Public Spending for Transportation and Water Infrastructure, 1956 to 2007

	Billions of 2009 Dollars	Share of GDP
1956	122.8	2.6
1957	128.9	2.8
1958	135.9	2.9
1959	153.2	3.1
1960	153.8	3.0
1961	163.3	3.1
1962	166.4	3.0
1963	175.3	3.1
1964	179.3	3.0
1965	185.5	2.9
1966	189.9	2.8
1967	193.1	2.8
1968	193.7	2.8
1969	196.4	2.7
1970	194.4	2.8
1971	201.8	2.9
1972	205.2	2.8
1973	199.7	2.7
1974	190.6	2.6
1975	198.9	2.8
1976	200.5	2.8
1977	203.5	2.7
1978	210.3	2.6
1979	226.7	2.7
1980	233.8	2.8
1981	228.3	2.7
1982	214.3	2.6
1983	218.3	2.6
1984	227.5	2.5
1985	243.0	2.5
1986	256.0	2.6
1987	264.2	2.6
1988	273.8	2.6
1989	281.3	2.5

Continued

Table A-1. **Continued**

Total Public Spending for Transportation and Water Infrastructure, 1956 to 2007

	Billions of 2009 Dollars	Share of GDP
1990	289.4	2.5
1991	287.9	2.5
1992	295.2	2.5
1993	298.0	2.4
1994	308.1	2.5
1995	311.9	2.4
1996	312.2	2.4
1997	318.7	2.4
1998	326.2	2.3
1999	337.7	2.3
2000	345.6	2.3
2001	361.1	2.4
2002	375.4	2.5
2003	379.6	2.5
2004	370.9	2.4
2005	361.1	2.4
2006	358.7	2.4
2007	356.4	2.4

Source: Congressional Budget Office.

Notes: Total public spending is the sum of expenditures by the federal government and by state and local governments.

For the purposes of this analysis, the phrase "transportation and water infrastructure" encompasses the facilities and systems that support transportation, provide water resources, supply drinking water, and treat wastewater.

Spending expressed in constant dollars has been adjusted to reflect the effects of inflation between the year the spending occurred and a base year, which in this study is 2009.

Data on the federal government's outlays for transportation and water infrastructure are available through fiscal year 2009 and reflect spending that year under the American Recovery and Reinvestment Act. In contrast, the most recent data on state and local spending that span a 12-month period matching the federal fiscal year (October 1 through September 30) are from 2007. Therefore, to be able to express annual state and local spending for infrastructure on a basis that is consistent with federal fiscal years, CBO reports total public spending for infrastructure—the sum of federal, state, and local expenditures—through 2007.

GDP = gross domestic product.

Table A-2.

Total Public Spending for Transportation and Water Infrastructure, by Level of Government, 1956 to 2007

	Federal		State and Local		Total
	Billions of 2009 Dollars	Share of Total	Billions of 2009 Dollars	Share of Total	Public Spending
1956	19.0	0.15	103.8	0.85	122.8
1957	21.6	0.17	107.3	0.83	128.9
1958	27.4	0.20	108.5	0.80	135.9
1959	42.6	0.28	110.6	0.72	153.2
1960	47.7	0.31	106.2	0.69	153.8
1961	47.5	0.29	115.8	0.71	163.3
1962	48.6	0.29	117.7	0.71	166.4
1963	51.6	0.29	123.7	0.71	175.3
1964	57.1	0.32	122.2	0.68	179.3
1965	60.8	0.33	124.7	0.67	185.5
1966	59.8	0.31	130.1	0.69	189.9
1967	58.9	0.31	134.1	0.69	193.1
1968	59.2	0.31	134.5	0.69	193.7
1969	57.2	0.29	139.3	0.71	196.4
1970	55.6	0.29	138.8	0.71	194.4
1971	60.2	0.30	141.6	0.70	201.8
1972	59.2	0.29	146.0	0.71	205.2
1973	61.1	0.31	138.6	0.69	199.7
1974	59.4	0.31	131.2	0.69	190.6
1975	61.9	0.31	137.0	0.69	198.9
1976	71.8	0.36	128.8	0.64	200.5
1977	78.4	0.39	125.1	0.61	203.5
1978	77.4	0.37	133.0	0.63	210.3
1979	82.4	0.36	144.3	0.64	226.7
1980	88.5	0.38	145.3	0.62	233.8
1981	82.9	0.36	145.5	0.64	228.3
1982	68.7	0.32	145.7	0.68	214.3
1983	65.6	0.30	152.7	0.70	218.3
1984	70.5	0.31	156.9	0.69	227.5
1985	75.5	0.31	167.5	0.69	243.0
1986	77.1	0.30	178.9	0.70	256.0
1987	68.4	0.26	195.8	0.74	264.2
1988	70.2	0.26	203.6	0.74	273.8
1989	69.6	0.25	211.7	0.75	281.3

Continued

Table A-2. **Continued**

Total Public Spending for Transportation and Water Infrastructure, by Level of Government, 1956 to 2007

	Federal		State and Local		Total
	Billions of 2009 Dollars	Share of Total	Billions of 2009 Dollars	Share of Total	Public Spending
1990	71.7	0.25	217.7	0.75	289.4
1991	72.7	0.25	215.1	0.75	287.9
1992	76.6	0.26	218.6	0.74	295.2
1993	77.3	0.26	220.7	0.74	298.0
1994	80.7	0.26	227.3	0.74	308.1
1995	80.4	0.26	231.5	0.74	311.9
1996	78.0	0.25	234.2	0.75	312.2
1997	77.6	0.24	241.1	0.76	318.7
1998	79.4	0.24	246.8	0.76	326.2
1999	82.8	0.25	254.9	0.75	337.7
2000	86.1	0.25	259.5	0.75	345.6
2001	97.2	0.27	263.9	0.73	361.1
2002	102.1	0.27	273.3	0.73	375.4
2003	99.0	0.26	280.6	0.74	379.6
2004	93.4	0.25	277.5	0.75	370.9
2005	90.3	0.25	270.8	0.75	361.1
2006	87.4	0.24	271.3	0.76	358.7
2007	81.7	0.23	274.7	0.77	356.4

Source: Congressional Budget Office.

Notes: Total public spending is the sum of expenditures by the federal government and by state and local governments.

For the purposes of this analysis, the phrase "transportation and water infrastructure" encompasses the facilities and systems that support transportation, provide water resources, supply drinking water, and treat wastewater.

Spending expressed in constant dollars has been adjusted to reflect the effects of inflation between the year the spending occurred and a base year, which in this study is 2009.

Data on the federal government's outlays for transportation and water infrastructure are available through fiscal year 2009 and reflect spending that year under the American Recovery and Reinvestment Act. In contrast, the most recent data on state and local spending that span a 12-month period matching the federal fiscal year (October 1 through September 30) are from 2007. Therefore, to be able to express annual state and local spending for infrastructure on a basis that is consistent with federal fiscal years, CBO reports total public spending for infrastructure—the sum of federal, state, and local expenditures—through 2007.

Table A-3.

Total Public Spending for Transportation and Water Infrastructure: Expenditures for Capital and Related Operation and Maintenance, 1956 to 2007

	Capital		Operation and Maintenance		Total
	Billions of 2009 Dollars	Share of Total	Billions of 2009 Dollars	Share of Total	Public Spending
1956	70.8	0.58	52.0	0.42	122.8
1957	73.3	0.57	55.7	0.43	128.9
1958	80.3	0.59	55.6	0.41	135.9
1959	92.8	0.61	60.5	0.39	153.2
1960	91.8	0.60	62.0	0.40	153.8
1961	98.3	0.60	65.0	0.40	163.3
1962	102.5	0.62	63.9	0.38	166.4
1963	107.8	0.61	67.5	0.39	175.3
1964	111.5	0.62	67.8	0.38	179.3
1965	115.1	0.62	70.4	0.38	185.5
1966	116.4	0.61	73.5	0.39	189.9
1967	118.5	0.61	74.6	0.39	193.1
1968	117.6	0.61	76.1	0.39	193.7
1969	118.5	0.60	77.9	0.40	196.4
1970	113.2	0.58	81.2	0.42	194.4
1971	116.6	0.58	85.2	0.42	201.8
1972	118.3	0.58	86.9	0.42	205.2
1973	111.1	0.56	88.6	0.44	199.7
1974	100.7	0.53	89.9	0.47	190.6
1975	100.8	0.51	98.2	0.49	198.9
1976	100.6	0.50	99.9	0.50	200.5
1977	97.8	0.48	105.8	0.52	203.5
1978	99.3	0.47	111.1	0.53	210.3
1979	112.3	0.50	114.4	0.50	226.7
1980	116.5	0.50	117.3	0.50	233.8
1981	103.6	0.45	124.7	0.55	228.3
1982	93.2	0.43	121.1	0.57	214.3
1983	94.4	0.43	123.9	0.57	218.3
1984	101.6	0.45	125.9	0.55	227.5
1985	113.5	0.47	129.6	0.53	243.0
1986	121.6	0.47	134.4	0.53	256.0
1987	126.9	0.48	137.3	0.52	264.2
1988	133.3	0.49	140.5	0.51	273.8
1989	136.2	0.48	145.0	0.52	281.3

Continued

Table A-3. **Continued**

Total Public Spending for Transportation and Water Infrastructure: Expenditures for Capital and Related Operation and Maintenance, 1956 to 2007

	Capital		Operation and Maintenance		Total
	Billions of 2009 Dollars	Share of Total	Billions of 2009 Dollars	Share of Total	Public Spending
1990	141.0	0.49	148.4	0.51	289.4
1991	143.5	0.50	144.4	0.50	287.9
1992	145.2	0.49	149.9	0.51	295.2
1993	144.8	0.49	153.2	0.51	298.0
1994	147.1	0.48	161.0	0.52	308.1
1995	147.7	0.47	164.3	0.53	311.9
1996	146.4	0.47	165.8	0.53	312.2
1997	148.4	0.47	170.3	0.53	318.7
1998	152.8	0.47	173.4	0.53	326.2
1999	162.2	0.48	175.4	0.52	337.7
2000	168.1	0.49	177.5	0.51	345.6
2001	175.6	0.49	185.5	0.51	361.1
2002	184.7	0.49	190.7	0.51	375.4
2003	188.3	0.50	191.3	0.50	379.6
2004	182.9	0.49	188.1	0.51	370.9
2005	171.3	0.47	189.7	0.53	361.1
2006	167.4	0.47	191.3	0.53	358.7
2007	160.8	0.45	195.5	0.55	356.4

Source: Congressional Budget Office.

Notes: Total public spending is the sum of expenditures by the federal government and by state and local governments.

For the purposes of this analysis, the phrase "transportation and water infrastructure" encompasses the facilities and systems that support transportation, provide water resources, supply drinking water, and treat wastewater.

Spending expressed in constant dollars has been adjusted to reflect the effects of inflation between the year the spending occurred and a base year, which in this study is 2009.

Capital spending includes the purchase, construction, rehabilitation, or improvement of physical assets, such as land, facilities, and equipment. The remaining portion of public expenditures consists of noncapital outlays—primarily for the operation and maintenance of physical assets. When calculating spending for operation and maintenance, CBO also includes spending on investment in intangible assets (for instance, for research and development), as well as expenditures for administrative activities and public outreach (such as educational and safety programs).

Data on the federal government's outlays for transportation and water infrastructure are available through fiscal year 2009 and reflect spending that year under the American Recovery and Reinvestment Act. In contrast, the most recent data on state and local spending that span a 12-month period matching the federal fiscal year (October 1 through September 30) are from 2007. Therefore, to be able to express annual state and local spending for infrastructure on a basis that is consistent with federal fiscal years, CBO reports total public spending for infrastructure—the sum of federal, state, and local expenditures—through 2007.

Table A-4.

Total Public Spending for Transportation and Water Infrastructure Capital, by Level of Government, 1956 to 2007

	Federal		State and Local		Total
	Billions of 2009 Dollars	Share of Total	Billions of 2009 Dollars	Share of Total	Public Spending
1956	13.8	0.19	57.0	0.81	70.8
1957	15.7	0.21	57.6	0.79	73.3
1958	22.7	0.28	57.6	0.72	80.3
1959	35.1	0.38	57.6	0.62	92.8
1960	39.6	0.43	52.3	0.57	91.8
1961	38.5	0.39	59.8	0.61	98.3
1962	40.2	0.39	62.2	0.61	102.5
1963	42.6	0.39	65.2	0.61	107.8
1964	47.9	0.43	63.6	0.57	111.5
1965	50.5	0.44	64.5	0.56	115.1
1966	49.4	0.42	67.0	0.58	116.4
1967	48.2	0.41	70.3	0.59	118.5
1968	47.7	0.41	69.9	0.59	117.6
1969	45.2	0.38	73.3	0.62	118.5
1970	42.8	0.38	70.5	0.62	113.2
1971	45.2	0.39	71.4	0.61	116.6
1972	44.6	0.38	73.7	0.62	118.3
1973	45.2	0.41	65.9	0.59	111.1
1974	44.1	0.44	56.6	0.56	100.7
1975	43.6	0.43	57.2	0.57	100.8
1976	51.9	0.52	48.7	0.48	100.6
1977	58.5	0.60	39.3	0.40	97.8
1978	55.7	0.56	43.6	0.44	99.3
1979	61.0	0.54	51.3	0.46	112.3
1980	65.6	0.56	50.8	0.44	116.5
1981	55.2	0.53	48.4	0.47	103.6
1982	48.0	0.51	45.2	0.49	93.2
1983	47.2	0.50	47.2	0.50	94.4
1984	52.3	0.52	49.3	0.48	101.6
1985	57.5	0.51	56.0	0.49	113.5
1986	60.2	0.50	61.4	0.50	121.6
1987	52.0	0.41	74.9	0.59	126.9
1988	53.7	0.40	79.6	0.60	133.3
1989	52.5	0.39	83.8	0.61	136.2

Continued

Table A-4. **Continued**

Total Public Spending for Transportation and Water Infrastructure Capital, by Level of Government, 1956 to 2007

	Federal		State and Local		Total
	Billions of 2009 Dollars	Share of Total	Billions of 2009 Dollars	Share of Total	Public Spending
1990	54.9	0.39	86.1	0.61	141.0
1991	55.8	0.39	87.6	0.61	143.5
1992	57.4	0.40	87.8	0.60	145.2
1993	59.1	0.41	85.7	0.59	144.8
1994	60.6	0.41	86.4	0.59	147.1
1995	60.4	0.41	87.3	0.59	147.7
1996	58.5	0.40	87.9	0.60	146.4
1997	57.1	0.38	91.3	0.62	148.4
1998	59.0	0.39	93.8	0.61	152.8
1999	62.8	0.39	99.4	0.61	162.2
2000	66.9	0.40	101.2	0.60	168.1
2001	73.6	0.42	102.0	0.58	175.6
2002	78.3	0.42	106.4	0.58	184.7
2003	75.0	0.40	113.3	0.60	188.3
2004	70.3	0.38	112.6	0.62	182.9
2005	65.9	0.38	105.5	0.62	171.3
2006	64.0	0.38	103.3	0.62	167.4
2007	58.0	0.36	102.8	0.64	160.8

Source: Congressional Budget Office.

Notes: Total public spending is the sum of expenditures by the federal government and by state and local governments.

For the purposes of this analysis, the phrase "transportation and water infrastructure" encompasses the facilities and systems that support transportation, provide water resources, supply drinking water, and treat wastewater.

Spending expressed in constant dollars has been adjusted to reflect the effects of inflation between the year the spending occurred and a base year, which in this study is 2009.

Capital spending includes the purchase, construction, rehabilitation, or improvement of physical assets, such as land, facilities, and equipment.

Data on the federal government's outlays for transportation and water infrastructure are available through fiscal year 2009 and reflect spending that year under the American Recovery and Reinvestment Act. In contrast, the most recent data on state and local spending that span a 12-month period matching the federal fiscal year (October 1 through September 30) are from 2007. Therefore, to be able to express annual state and local spending for infrastructure on a basis that is consistent with federal fiscal years, CBO reports total public spending for infrastructure—the sum of federal, state, and local expenditures—through 2007.

Table A-5.

Total Federal Spending for Transportation and Water Infrastructure Capital: Grants and Loan Subsidies and Other Spending, 1956 to 2009

	Grants and Loan Subsidies		Other Spending		Total
	Billions of 2009 Dollars	Share of Total	Billions of 2009 Dollars	Share of Total	Federal Spending
1956	8.0	0.58	5.8	0.42	13.8
1957	9.5	0.61	6.2	0.39	15.7
1958	15.2	0.67	7.5	0.33	22.7
1959	26.3	0.75	8.8	0.25	35.1
1960	30.3	0.77	9.3	0.23	39.6
1961	27.7	0.72	10.8	0.28	38.5
1962	28.8	0.71	11.5	0.29	40.2
1963	30.5	0.72	12.1	0.28	42.6
1964	36.0	0.75	11.9	0.25	47.9
1965	38.8	0.77	11.7	0.23	50.5
1966	37.1	0.75	12.2	0.25	49.4
1967	36.1	0.75	12.1	0.25	48.2
1968	36.8	0.77	10.9	0.23	47.7
1969	35.8	0.79	9.4	0.21	45.2
1970	34.6	0.81	8.2	0.19	42.8
1971	35.9	0.79	9.4	0.21	45.2
1972	34.4	0.77	10.2	0.23	44.6
1973	35.0	0.77	10.2	0.23	45.2
1974	34.5	0.78	9.5	0.22	44.1
1975	34.3	0.79	9.3	0.21	43.6
1976	42.8	0.82	9.2	0.18	51.9
1977	46.1	0.79	12.4	0.21	58.5
1978	43.9	0.79	11.7	0.21	55.7
1979	48.8	0.80	12.3	0.20	61.0
1980	53.1	0.81	12.6	0.19	65.6
1981	46.3	0.84	9.0	0.16	55.2
1982	39.5	0.82	8.4	0.18	48.0
1983	39.3	0.83	7.9	0.17	47.2
1984	44.4	0.85	7.9	0.15	52.3
1985	49.6	0.86	7.9	0.14	57.5
1986	52.3	0.87	7.9	0.13	60.2
1987	44.0	0.85	8.0	0.15	52.0
1988	45.0	0.84	8.7	0.16	53.7
1989	43.9	0.84	8.6	0.16	52.5

Continued

Table A-5. **Continued**

Total Federal Spending on Transportation and Water Infrastructure Capital: Grants and Loan Subsidies and Other Spending, 1956 to 2009

	Grants and Loan Subsidies		Other Spending		Total
	Billions of 2009 Dollars	Share of Total	Billions of 2009 Dollars	Share of Total	Federal Spending
1990	45.9	0.84	9.0	0.16	54.9
1991	46.4	0.83	9.5	0.17	55.8
1992	47.2	0.82	10.2	0.18	57.4
1993	49.5	0.84	9.6	0.16	59.1
1994	51.2	0.84	9.4	0.16	60.6
1995	50.5	0.84	10.0	0.16	60.4
1996	48.8	0.83	9.7	0.17	58.5
1997	48.2	0.84	8.9	0.16	57.1
1998	49.3	0.84	9.6	0.16	59.0
1999	52.9	0.84	9.9	0.16	62.8
2000	56.1	0.84	10.8	0.16	66.9
2001	60.9	0.83	12.6	0.17	73.6
2002	65.6	0.84	12.7	0.16	78.3
2003	63.7	0.85	11.3	0.15	75.0
2004	60.0	0.85	10.3	0.15	70.3
2005	56.3	0.86	9.5	0.14	65.9
2006	54.5	0.85	9.5	0.15	64.0
2007	49.5	0.85	8.5	0.15	58.0
2008	48.9	0.9	8.4	0.15	57.3
2009	54.7	0.9	9.3	0.14	64.0

Source: Congressional Budget Office.

Notes: For the purposes of this analysis, the phrase "transportation and water infrastructure" encompasses the facilities and systems that support transportation, provide water resources, supply drinking water, and treat wastewater.

Spending expressed in constant dollars has been adjusted to reflect the effects of inflation between the year the spending occurred and a base year, which in this study is 2009.

Capital spending includes the purchase, construction, rehabilitation, or improvement of physical assets, such as land, facilities, and equipment.

Federal grants are typically payments that reimburse state and local governments for expenses they have incurred. Federal credit subsidies result when the government makes loans at below-market rates or incurs financial liability by guaranteeing the loans of borrowers who might default.

Data on the federal government's outlays for transportation and water infrastructure are available through fiscal year 2009 and reflect spending that year under the American Recovery and Reinvestment Act. In contrast, the most recent data on state and local spending that span a 12-month period matching the federal fiscal year (October 1 through September 30) are from 2007. Therefore, to be able to express annual state and local spending for infrastructure on a basis that is consistent with federal fiscal years, CBO reports total public spending for infrastructure—the sum of federal, state, and local expenditures—through 2007.

Table A-6.

Total Public Spending for the Operation and Maintenance of Transportation and Water Infrastructure, by Level of Government, 1956 to 2007

	Federal		State and Local		Total
	Billions of 2009 Dollars	Share of Total	Billions of 2009 Dollars	Share of Total	Public Spending
1956	5.2	0.10	46.8	0.90	52.0
1957	5.9	0.11	49.8	0.89	55.7
1958	4.7	0.08	50.9	0.92	55.6
1959	7.5	0.12	52.9	0.88	60.5
1960	8.1	0.13	53.9	0.87	62.0
1961	9.0	0.14	56.1	0.86	65.0
1962	8.4	0.13	55.5	0.87	63.9
1963	9.0	0.13	58.5	0.87	67.5
1964	9.2	0.14	58.6	0.86	67.8
1965	10.2	0.15	60.2	0.85	70.4
1966	10.4	0.14	63.0	0.86	73.5
1967	10.7	0.14	63.8	0.86	74.6
1968	11.5	0.15	64.6	0.85	76.1
1969	12.0	0.15	66.0	0.85	77.9
1970	12.9	0.16	68.3	0.84	81.2
1971	15.0	0.18	70.2	0.82	85.2
1972	14.6	0.17	72.3	0.83	86.9
1973	15.9	0.18	72.7	0.82	88.6
1974	15.3	0.17	74.6	0.83	89.9
1975	18.3	0.19	79.8	0.81	98.2
1976	19.8	0.20	80.1	0.80	99.9
1977	19.9	0.19	85.8	0.81	105.8
1978	21.7	0.20	89.4	0.80	111.1
1979	21.4	0.19	93.1	0.81	114.4
1980	22.9	0.19	94.5	0.81	117.3
1981	27.6	0.22	97.1	0.78	124.7
1982	20.7	0.17	100.4	0.83	121.1
1983	18.4	0.15	105.5	0.85	123.9
1984	18.2	0.14	107.7	0.86	125.9
1985	18.0	0.14	111.5	0.86	129.6
1986	16.9	0.13	117.6	0.87	134.4
1987	16.4	0.12	120.9	0.88	137.3
1988	16.5	0.12	124.0	0.88	140.5
1989	17.1	0.12	127.9	0.88	145.0

Continued

Table A-6. **Continued**

Total Public Spending for the Operation and Maintenance of Transportation and Water Infrastructure, by Level of Government, 1956 to 2007

	Federal		State and Local		Total
	Billions of 2009 Dollars	Share of Total	Billions of 2009 Dollars	Share of Total	Public Spending
1990	16.8	0.11	131.6	0.89	148.4
1991	16.9	0.12	127.5	0.88	144.4
1992	19.2	0.13	130.8	0.87	149.9
1993	18.2	0.12	135.0	0.88	153.2
1994	20.1	0.13	140.9	0.87	161.0
1995	20.0	0.12	144.3	0.88	164.3
1996	19.5	0.12	146.3	0.88	165.8
1997	20.5	0.12	149.8	0.88	170.3
1998	20.4	0.12	153.0	0.88	173.4
1999	20.0	0.11	155.5	0.89	175.4
2000	19.2	0.11	158.3	0.89	177.5
2001	23.6	0.13	161.9	0.87	185.5
2002	23.7	0.12	167.0	0.88	190.7
2003	24.0	0.13	167.3	0.87	191.3
2004	23.1	0.12	165.0	0.88	188.1
2005	24.4	0.13	165.3	0.87	189.7
2006	23.4	0.12	167.9	0.88	191.3
2007	23.7	0.12	171.9	0.88	195.5

Source: Congressional Budget Office.

Notes: Total public spending is the sum of expenditures by the federal government and by state and local governments.

For the purposes of this analysis, the phrase "transportation and water infrastructure" encompasses the facilities and systems that support transportation, provide water resources, supply drinking water, and treat wastewater.

Spending expressed in constant dollars has been adjusted to reflect the effects of inflation between the year the spending occurred and a base year, which in this study is 2009.

When calculating spending for operation and maintenance, which pertains primarily to physical assets, CBO also includes spending on investment in intangible assets (for instance, for research and development), as well as expenditures for administrative activities and public outreach (such as educational and safety programs).

Data on the federal government's outlays for transportation and water infrastructure are available through fiscal year 2009 and reflect spending that year under the American Recovery and Reinvestment Act. In contrast, the most recent data on state and local spending that span a 12-month period matching the federal fiscal year (October 1 through September 30) are from 2007. Therefore, to be able to express annual state and local spending for infrastructure on a basis that is consistent with federal fiscal years, CBO reports total public spending for infrastructure—the sum of federal, state, and local expenditures—through 2007.

Table A-7.

Total Public Spending for Transportation and Water Infrastructure, by Type of Infrastructure, 1956 to 2007

(Billions of 2009 dollars)

	Highways	Aviation, Mass Transit, and Rail	Water Supply and Wastewater Treatment	Water Transportation and Water Resources	Total Public Spending
1956	77.0	10.3	22.9	12.5	122.8
1957	80.8	10.9	23.5	13.7	128.9
1958	86.5	11.9	23.2	14.3	135.9
1959	96.6	13.8	25.2	17.7	153.2
1960	95.6	15.0	27.2	16.0	153.8
1961	99.8	16.8	28.8	17.9	163.3
1962	103.0	17.2	29.4	16.9	166.4
1963	107.6	17.9	31.4	18.4	175.3
1964	110.2	18.1	32.0	19.0	179.3
1965	112.9	20.1	33.9	18.6	185.5
1966	112.7	19.6	35.7	21.9	189.9
1967	117.1	21.0	32.6	22.3	193.1
1968	116.3	22.4	33.0	22.0	193.7
1969	117.1	24.6	34.4	20.3	196.4
1970	115.1	25.8	35.2	18.3	194.4
1971	116.5	29.0	37.0	19.3	201.8
1972	115.7	30.7	39.5	19.2	205.2
1973	106.2	33.9	40.2	19.4	199.7
1974	98.7	31.8	41.6	18.5	190.6
1975	97.5	36.7	45.5	19.2	198.9
1976	98.4	37.9	46.1	18.1	200.5
1977	94.0	41.8	49.0	18.8	203.5
1978	99.6	42.2	49.4	19.1	210.3
1979	107.9	44.2	53.5	21.1	226.7
1980	108.7	47.8	55.0	22.3	233.8
1981	98.1	53.2	55.9	21.2	228.3
1982	90.9	49.5	54.7	19.3	214.3
1983	93.8	50.0	54.9	19.6	218.3
1984	101.7	52.0	54.3	19.6	227.5
1985	112.8	52.0	57.7	20.5	243.0
1986	118.5	54.0	62.8	20.7	256.0
1987	119.8	55.7	67.4	21.3	264.2
1988	123.3	56.7	69.4	24.4	273.8
1989	126.2	58.4	71.5	25.1	281.3

Continued

Table A-7. **Continued**

Total Public Spending for Transportation and Water Infrastructure, by Type of Infrastructure, 1956 to 2007

(Billions of 2009 dollars)

	Highways	Aviation, Mass Transit, and Rail	Water Supply and Wastewater Treatment	Water Transportation and Water Resources	Total Public Spending
1990	128.5	60.9	74.2	25.7	289.4
1991	131.7	65.1	77.0	14.1	287.9
1992	133.3	69.2	78.0	14.7	295.2
1993	135.0	69.6	78.9	14.4	298.0
1994	140.2	74.3	78.7	14.9	308.1
1995	142.6	73.3	81.6	14.5	312.0
1996	141.4	73.3	83.1	14.4	312.2
1997	143.2	76.2	85.4	14.0	318.8
1998	149.6	75.5	85.5	15.6	326.2
1999	155.9	77.5	87.7	16.6	337.7
2000	161.3	80.0	86.8	17.5	345.6
2001	165.4	85.5	87.3	22.8	361.0
2002	171.0	92.1	92.7	19.5	375.4
2003	168.6	95.5	95.0	20.5	379.6
2004	164.7	93.7	95.7	16.8	370.9
2005	160.3	89.3	94.1	17.3	361.0
2006	159.4	85.9	96.3	17.1	358.7
2007	154.5	83.6	101.3	16.9	356.4

Source: Congressional Budget Office.

Notes: Total public spending is the sum of expenditures by the federal government and by state and local governments.

For the purposes of this analysis, the phrase "transportation and water infrastructure" encompasses the facilities and systems that support transportation, provide water resources, supply drinking water, and treat wastewater.

Spending expressed in constant dollars has been adjusted to reflect the effects of inflation between the year the spending occurred and a base year, which in this study is 2009.

Data on the federal government's outlays for transportation and water infrastructure are available through fiscal year 2009 and reflect spending that year under the American Recovery and Reinvestment Act. In contrast, the most recent data on state and local spending that span a 12-month period matching the federal fiscal year (October 1 through September 30) are from 2007. Therefore, to be able to express annual state and local spending for infrastructure on a basis that is consistent with federal fiscal years, CBO reports total public spending for infrastructure—the sum of federal, state, and local expenditures—through 2007.

Data on public spending for water transportation and water resources after 1990 do not include expenditures by states and localities on water resources.

Table A-8.

Total Public Spending for Transportation and Water Infrastructure Capital, by Type of Infrastructure, 1956 to 2007

(Billions of 2009 dollars)

	Highways	Aviation, Mass Transit, and Rail	Water Supply and Wastewater Treatment	Water Transportation and Water Resources	Total Public Spending
1956	48.8	2.3	12.5	7.1	70.8
1957	50.4	2.8	12.6	7.5	73.3
1958	55.2	3.9	12.2	9.0	80.3
1959	64.6	3.9	14.1	10.2	92.8
1960	63.0	4.0	14.9	9.8	91.8
1961	65.5	5.3	15.8	11.6	98.3
1962	69.5	4.6	16.4	12.0	102.5
1963	72.5	4.6	17.4	13.2	107.8
1964	75.5	4.2	18.4	13.5	111.5
1965	77.2	5.0	20.0	12.9	115.1
1966	76.4	4.5	20.9	14.7	116.4
1967	80.2	5.4	17.9	15.0	118.5
1968	79.0	6.3	18.0	14.3	117.6
1969	79.1	8.1	19.0	12.3	118.5
1970	76.1	7.8	19.0	10.4	113.2
1971	76.7	8.2	20.2	11.4	116.6
1972	75.4	9.4	22.0	11.5	118.3
1973	65.9	12.3	22.0	10.9	111.1
1974	58.1	9.4	22.4	10.7	100.7
1975	55.1	9.9	25.1	10.7	100.8
1976	55.7	10.8	24.6	9.5	100.6
1977	50.7	12.2	24.8	10.1	97.8
1978	54.3	11.7	23.8	9.4	99.3
1979	61.9	13.3	26.9	10.2	112.3
1980	63.1	14.5	27.7	11.0	116.5
1981	53.6	12.8	27.2	10.1	103.6
1982	46.2	13.2	24.2	9.7	93.2
1983	47.6	14.0	23.1	9.6	94.4
1984	54.6	15.1	22.0	9.8	101.6
1985	63.8	15.3	24.0	10.3	113.5
1986	67.8	16.3	27.1	10.5	121.6
1987	68.7	17.4	30.1	10.7	126.9
1988	73.3	17.5	31.1	11.4	133.3
1989	75.2	18.4	31.1	11.7	136.2

Continued

Table A-8. **Continued**

Total Public Spending for Transportation and Water Infrastructure Capital, by Type of Infrastructure, 1956 to 2007

(Billions of 2009 dollars)

	Highways	Aviation, Mass Transit, and Rail	Water Supply and Wastewater Treatment	Water Transportation and Water Resources	Total Public Spending
1990	76.3	20.6	31.9	12.2	141.0
1991	79.2	22.4	33.9	8.0	143.5
1992	79.7	24.6	33.4	7.4	145.2
1993	80.3	25.7	31.6	7.2	144.8
1994	84.1	27.4	28.4	7.2	147.1
1995	85.3	25.9	29.7	6.8	147.7
1996	83.5	25.6	30.2	7.0	146.4
1997	83.8	27.0	31.4	6.2	148.4
1998	88.7	27.3	30.1	6.7	152.8
1999	93.3	28.6	32.3	8.0	162.2
2000	96.4	30.6	31.3	9.9	168.1
2001	99.5	32.2	30.5	13.3	175.6
2002	103.5	36.9	34.1	10.2	184.7
2003	101.1	39.4	36.7	11.1	188.3
2004	98.7	39.1	36.8	8.3	182.9
2005	94.0	33.6	35.9	7.8	171.3
2006	92.5	30.2	36.5	8.2	167.4
2007	87.5	26.6	38.9	7.8	160.8

Source: Congressional Budget Office.

Notes: Total public spending is the sum of expenditures by the federal government and by state and local governments.

For the purposes of this analysis, the phrase "transportation and water infrastructure" encompasses the facilities and systems that support transportation, provide water resources, supply drinking water, and treat wastewater.

Spending expressed in constant dollars has been adjusted to reflect the effects of inflation between the year the spending occurred and a base year, which in this study is 2009.

Capital spending includes the purchase, construction, rehabilitation, or improvement of physical assets, such as land, facilities, and equipment.

Data on the federal government's outlays for transportation and water infrastructure are available through fiscal year 2009 and reflect spending that year under the American Recovery and Reinvestment Act. In contrast, the most recent data on state and local spending that span a 12-month period matching the federal fiscal year (October 1 through September 30) are from 2007. Therefore, to be able to express annual state and local spending for infrastructure on a basis that is consistent with federal fiscal years, CBO reports total public spending for infrastructure—the sum of federal, state, and local expenditures—through 2007.

Data on public spending for water transportation and water resources after 1990 do not include expenditures by states and localities on water resources.

Table A-9.

Total Public Spending for the Operation and Maintenance of Transportation and Water Infrastructure, by Type of Infrastructure, 1956 to 2007

(Billions of 2009 dollars)

	Highways	Aviation, Mass Transit, and Rail	Water Supply and Wastewater Treatment	Water Transportation and Water Resources	Total Public Spending
1956	28.2	8.0	10.4	5.4	52.0
1957	30.4	8.1	10.9	6.2	55.7
1958	31.3	8.0	11.1	5.3	55.6
1959	32.0	9.9	11.1	7.5	60.5
1960	32.6	11.0	12.3	6.2	62.0
1961	34.3	11.5	13.0	6.3	65.0
1962	33.4	12.6	13.0	4.9	63.9
1963	35.0	13.3	14.0	5.2	67.5
1964	34.7	13.9	13.6	5.5	67.8
1965	35.6	15.1	14.0	5.7	70.4
1966	36.3	15.1	14.8	7.2	73.5
1967	36.8	15.6	14.7	7.4	74.6
1968	37.3	16.1	15.0	7.7	76.1
1969	38.0	16.4	15.4	8.0	77.9
1970	39.0	18.0	16.2	7.9	81.2
1971	39.8	20.8	16.7	7.9	85.2
1972	40.3	21.3	17.5	7.7	86.9
1973	40.2	21.6	18.2	8.5	88.6
1974	40.5	22.4	19.2	7.8	89.9
1975	42.4	26.8	20.4	8.5	98.2
1976	42.7	27.0	21.5	8.6	99.9
1977	43.2	29.4	24.2	8.7	105.8
1978	45.2	30.3	25.6	9.7	111.1
1979	45.9	30.8	26.7	10.9	114.4
1980	45.5	33.0	27.3	11.2	117.3
1981	44.4	40.2	28.7	11.1	124.7
1982	44.7	36.2	30.5	9.6	121.1
1983	46.2	35.9	31.7	10.0	123.9
1984	47.0	36.8	32.2	9.8	125.9
1985	49.1	36.7	33.7	10.1	129.6
1986	50.7	37.8	35.7	10.3	134.4
1987	51.1	38.3	37.3	10.7	137.3
1988	50.1	39.3	38.2	13.0	140.5
1989	51.1	40.1	40.5	13.5	145.0

Continued

Table A-9. **Continued**

Total Public Spending for the Operation and Maintenance of Transportation and Water Infrastructure, by Type of Infrastructure, 1956 to 2007

(Billions of 2009 dollars)

	Highways	Aviation, Mass Transit, and Rail	Water Supply and Wastewater Treatment	Water Transportation and Water Resources	Total Public Spending
1990	52.2	40.4	42.3	13.5	148.4
1991	52.6	42.7	43.1	6.1	144.4
1992	53.5	44.6	44.6	7.3	149.9
1993	54.7	44.0	47.3	7.3	153.2
1994	56.1	46.9	50.3	7.7	161.0
1995	57.3	47.4	51.8	7.7	164.3
1996	57.9	47.6	52.9	7.4	165.8
1997	59.4	49.2	54.0	7.7	170.3
1998	61.0	48.1	55.3	8.9	173.4
1999	62.6	48.8	55.4	8.6	175.4
2000	64.9	49.4	55.5	7.6	177.5
2001	65.9	53.2	56.8	9.5	185.5
2002	67.5	55.1	58.6	9.4	190.7
2003	67.5	56.0	58.3	9.4	191.3
2004	66.0	54.5	58.8	8.5	188.1
2005	66.3	55.6	58.2	9.5	189.7
2006	66.9	55.7	59.7	8.9	191.3
2007	67.0	57.0	62.4	9.1	195.5

Source: Congressional Budget Office.

Notes: Total public spending is the sum of expenditures by the federal government and by state and local governments.

For the purposes of this analysis, the phrase "transportation and water infrastructure" encompasses the facilities and systems that support transportation, provide water resources, supply drinking water, and treat wastewater.

Spending expressed in constant dollars has been adjusted to reflect the effects of inflation between the year the spending occurred and a base year, which in this study is 2009.

When calculating spending for operation and maintenance, which pertains primarily to physical assets, CBO also includes spending on investment in intangible assets (for instance, for research and development), as well as expenditures for administrative activities and public outreach (such as educational and safety programs).

Data on the federal government's outlays for transportation and water infrastructure are available through fiscal year 2009 and reflect spending that year under the American Recovery and Reinvestment Act. In contrast, the most recent data on state and local spending that span a 12-month period matching the federal fiscal year (October 1 through September 30) are from 2007. Therefore, to be able to express annual state and local spending for infrastructure on a basis that is consistent with federal fiscal years, CBO reports total public spending for infrastructure—the sum of federal, state, and local expenditures—through 2007.

Data on public spending for water transportation and water resources after 1990 do not include expenditures by states and localities on water resources.

APPENDIX

B

Methodology and Data Sources

In this study, the Congressional Budget Office (CBO) reports on spending by the federal government and by state and local governments for seven types of transportation and water infrastructure: highways and roads; mass transit; rail; aviation; water transportation; water resources; and water supply and wastewater treatment. The study focuses on those forms of infrastructure because they draw heavily on federal resources. To determine the types of public spending and categories of infrastructure to evaluate, CBO used the same definitions it relied on in previous reports on this topic; in addition, the agency used information from the Office of Management and Budget (OMB) to confirm that those categories continue to be important elements of federal spending on infrastructure.[1]

Methodology

In its reports on public spending for transportation and water infrastructure, CBO has focused on two categories of spending: capital and operation and maintenance. Within those categories, only actual infrastructure expenditures—as opposed to the amount of public funds made available for that purpose—were analyzed. (That is, the federal government's spending on infrastructure capital and on operation and maintenance is reported in terms of outlays rather than as budget authority.) CBO reported gross public spending on infrastructure and thus did not subtract from spending totals the receipts collected for the use of services associated with infrastructure facilities.

Capital and Operation and Maintenance

To determine whether federal spending was designated for infrastructure capital or for related operation and maintenance, CBO applied the classification scheme for Character Class data that OMB collects, on its form schedule C, from federal agencies. Character Class data are divided into two types of spending: investment and noninvestment.[2] With only a few exceptions, which are noted below, the classification of an outlay in one of those categories indicates whether that federal spending was for capital projects or for operation and maintenance.

In calculating federal capital outlays, CBO included all spending on physical infrastructure. As reported on schedule C, federal investment in physical infrastructure includes "amounts for the purchase, construction, manufacture, rehabilitation, or major improvement of physical assets regardless of whether the assets are owned or operated by the Federal Government, States, municipalities, or private individuals. Physical assets are land, structures, equipment, and intellectual property (for example, software) that have an estimated useful life of two years or more, and commodity inventories. The cost of the asset includes both its purchase price and all other costs incurred to bring it to a form and location suitable for its use."[3]

To calculate the federal government's spending for operation and maintenance, CBO combined the remaining investment spending reported on schedule C (that is, investment in nonphysical infrastructure assets, such as research and development and education) and all other noninvestment spending.

1. See, respectively, Congressional Budget Office, *Trends in Public Spending on Transportation and Water Infrastructure, 1956 to 2004* (August 2007) and *Budget of the United States Government, Fiscal Year 2011: Analytical Perspectives,* Table 20-2: "Federal Investment Budget Authority and Outlays—Grant and Direct Federal Programs," pp. 332–334, www.whitehouse.gov/omb/budget/Analytical_Perspectives/.

2. See Office of Management and Budget, *Circular No. A-11: Preparation, Submission, and Execution of the Budget* (July 2010), Section 84, www.whitehouse.gov/sites/default/files/omb/assets/a11_current_year/a_11_2010.pdf.

3. Ibid., Section 84, p. 6.

To determine what constituted spending for infrastructure capital and related operation and maintenance at the state and local level, CBO used the definition reported in the Census Bureau's *Government Finance and Employment Classification Manual.*[4]

Table B-1 compares the definitions used by OMB and the Census Bureau to differentiate capital spending from spending for operation and maintenance at the federal level and at the state and local level.

Measurement Issues

To report actual federal outlays on infrastructure—as opposed to the amount of funding made available by the Congress for that purpose—CBO expressed the federal government's spending on infrastructure as outlays rather than budget authority. In addition, some federal programs earned revenues from the infrastructure services they provide; with a few small exceptions, such receipts were netted out from outlays reported by OMB, and CBO added them back in order to report gross federal spending on infrastructure.

Outlays, Budget Authority, and Obligations. With only a few exceptions, this study reports federal infrastructure spending in the form of outlays. OMB defines the term as "a payment to liquidate an obligation (other than the repayment of debt principal). Outlays generally are equal to cash disbursements … [and are] the measure of Government spending."[5] Outlays may reflect past and current budget authority—that is, "the authority provided by law to incur financial obligations that will [ultimately] result in outlays."[6]

In a few instances, OMB's schedule C data are not sufficiently detailed to distinguish federal infrastructure expenditures from other types of outlays. In those cases, CBO relied on additional sources of information for this study, including relevant chapters of the *Budget of the United States Government: Appendix* for various fiscal years, to collect the necessary data (those specific sources of data are listed in the data section of this appendix). In the President's budget, federal infrastructure spending is often expressed as an obligation—that is, as a "binding agreement that will result in outlays, immediately or in the future."[7]

Gross Versus Net Federal Outlays for Infrastructure. For this report, CBO measured gross spending—the total amount spent by government—for transportation and water infrastructure. Fees for the use of public infrastructure were not netted out from gross spending. Consequently, to calculate federal infrastructure spending, CBO excluded any budget accounts that were purely receipts accounts (accounts that serve simply to account for federal receipts related to the use of infrastructure). The most notable examples of such accounts are the trust funds that provide funding for surface transportation and aviation programs. However, that approach did not avoid all netting out of infrastructure receipts from gross federal infrastructure outlays. In particular, federal outlays for operation and maintenance reported on OMB's schedule C net out some user fees that are classified as offsetting collections (see Table B-1).[8] Offsetting collections are payments to the government that are credited to expenditure accounts and typically allow spending without an appropriation. When the Congress authorizes offsetting collections for a federal infrastructure program, the corresponding entry for operation and maintenance outlays will understate actual (or gross) direct spending from it.[9] That outcome is a result of the fact that schedule C data are collected for budgetary accounting—that is, for calculating the net outlays that determine the federal government's budget deficit or surplus—rather than for purposes of analysis.

The understatement of federal spending in the analysis presented in this study does not appear to be a substantial problem because the types of infrastructure that receive most federal funding typically do not have offsetting

4. See Census Bureau, *Federal, State and Local Governments: Government Finance and Employment Classification Manual,* Table 5.1: "Description of Character and Object Categories," available at www.census.gov/govs/www/06classificationmanual/chapter05-2.html#p2c5table51.

5. See Office of Management and Budget, *Circular No. A-11: Preparation, Submission, and Execution of the Budget* (July 2010), Section 20, p. 7.

6. Ibid., p. 3.

7. Ibid., p. 7.

8. In Table B-1, sales of physical infrastructure assets are entered as negative capital spending outlays because those sales reflect federal disinvestment in infrastructure capital.

9. An illustration is provided by Office of Management and Budget, *Circular No. A-11*: *Preparation, Submission, and Execution of the Budget* (July 2010), Section 84, p. 4.

collections that are netted out. For example, in 2002, the Government Accountability Office found that "the federal funding approach for aviation and highways relied almost exclusively on assessments on users of the transportation systems … [and] most of these collections were credited to trust fund accounts."[10] Although the federal infrastructure spending reported in this study includes outlays made from trust fund accounts, the corresponding receipts—in the form of excise taxes and other fees—are reported separately in the OMB data. As a result, outlays from trust funds were interpreted as gross federal spending.

In this study, where possible, CBO also identified federal infrastructure programs (other than those reliant on trust fund accounts) for which offsetting collections are especially relevant and then added those revenues back to the net outlays reported by OMB. To do so, CBO relied on the Object Class Analysis that is part of the President's budget each year and that reports offsetting collections from both federal and nonfederal sources.[11] Offsetting collections from nonfederal sources appear to be especially important for water resource programs (for example, dams, levees, and watersheds). Consequently, CBO revised the federal infrastucture spending reported for the following programs from 1998 through 2009 so that their net outlays are increased by the amount of their offsetting collections:

- Army Corps of Engineers
  - General Investigations;
  - Construction Program;
  - Operation and Maintenance; and
  - Flood Control and Coastal Emergencies.
- Bureau of Reclamation
  - Water and Related Resources Account;
  - Lower Colorado River Basin Fund Account; and
  - Upper Colorado River Basin Fund Account.

Federal Grants, Loan Subsidies, and Other Federal Infrastructure Spending. As with its calculations of capital spending and spending for operation and maintenance, CBO relied on the Character Class data collected on OMB's form schedule C to distinguish federal grants and loan subsidies to states and localities from other federal spending.[12] Federal grants and loan subsidies "support state or local programs of government operations or provision of services to the public."[13] Beyond what is reported in this study, information on federal grants and loan subsidies generally is also available in *Budget of the United States Government, Fiscal Year 2011: Analytical Perspectives.*[14]

Other federal infrastructure spending described in this study includes any that is not a grant or a loan subsidy.

Other Methodological Issues

To compare federal outlays on infrastructure in a given year with corresponding expenditures at the state and

10. See Government Accountability Office, *Marine Transportation: Federal Financing and a Framework for Infrastructure Investments*, GAO-02-1033 (September 2002), pp. 3–4, www.gao.gov/new.items/d021033.pdf.

11. The goal is to account for offsetting collections from nonfederal sources. If an infrastructure program receives offsetting collections from a federal source—say, from another program for which it had supplied infrastructure services—then that spending should be reported as an infrastructure outlay elsewhere in the budget.

12. The Federal Credit Reform Act of 1990 requires that when federal direct loan or loan guarantee programs are established or modified, they receive budget authority to cover the credit subsidy that the government provides through them. The value of the estimated loan subsidies are entered as federal outlays on schedule C. When those loan subsidy estimates are reestimated, any difference between the original estimate and the reestimate (either positive or negative) is entered as an outlay. Credit subsidy reestimates for infrastructure loan subsidies are included in this report because they represent the degree to which the financial burden to the federal government from offering those subsides in the past was overstated or understated.

13. See Office of Management and Budget, *Circular No. A-11: Preparation, Submission, and Execution of the Budget* (July 2010), Section 84, pp. 2–3.

14. See *Budget of the United States Government, Fiscal Year 2011: Analytical Perspectives,* Chapter 17: "Aid to State and Local Governments" (October 2010), pp. 247–314. Information on individual grant and loan programs can be found in Office of Management and Budget and General Services Administration, *2010 Catalog of Federal Domestic Assistance*, available at www.cfda.gov/downloads/CFDA_2010.pdf.

Table B-1.

Characteristics of Spending for Infrastructure Capital and for Related Operation and Maintenance, by Level of Government

	Level of Government	
Category of Spending	**Federal**	**State and Local**
Capital	*Construction and Rehabilitation:* Encompasses the design and production of fixed works and structures or substantial alterations to such structures or land. Includes new works and major additions, alterations, improvements to, and replacement of existing works. Excludes preliminary surveys, maintenance, repair, administration of such facilities, and other federal operating expenses.	*Construction:* Includes the production of, additions to, replacement of, or major structural alterations to fixed works undertaken either on a contractual basis by private contractors or through a government's own staff.
	Purchase and Sale of Land and Structures: Includes the purchase or lease-purchase of land and structures for use by the federal government and sales of such land and structures. Includes office buildings, parkland, and forests but does not include land or structures acquired as temporary inventory (such as collateral on defaulted loans).	*Purchase of Land and Existing Structures:* Includes the acquisition of such assets by outright purchase, payments on capital lease purchase agreements, or installment purchase contracts. Also takes into account the costs associated with exercising eminent domain (including the purchase of rights-of-way) and tax or special assessment foreclosure. Covers all ancillary costs associated with such transactions (for instance, legal and title fees; surveying fees; appraisal and negotiation fees; damage claims; and nonconstruction-related site-preparation costs, including the razing of unwanted structures and the clearing, filling, and leveling of construction sites).
	Major Equipment: Includes the purchase of equipment such as vehicles, ships, machine tools, and computers and other information technology hardware. Also includes equipment purchases called for by certain federal programs. Excludes routine purchases of ordinary office equipment or furniture and fixtures.	*Purchase of Equipment:* Includes the purchase and installation of apparatus, furnishings, motor vehicles, and office equipment with a life expectancy of more than five years. Includes new equipment or replacements purchased outright or through capital lease or installment purchase contracts. Includes related expenditures (for example, transportation charges, installation fees, and taxes).

Continued

Table B-1. **Continued**

Characteristics of Spending for Infrastructure Capital and for Related Operation and Maintenance, by Level of Government

Category of Spending	Level of Government: Federal	Level of Government: State and Local
Operation and Maintenance	*Research and Development:* Includes basic and applied research and development. (The latter form of R&D is defined as the systematic application of knowledge or understanding, directed toward the production of useful materials, devices, and systems or methods.) Includes the design, development, and improvement of prototypes and new processes to meet specific requirements.	*Research and Development:* Included in *Current Operations* (see below).
	Education and Training: Includes programs whose primary purpose is education, training, and vocational rehabilitation.	*Education and Training:* Included in *Current Operations* (see below).
	Noninvestment Activities: Includes federal spending for grants and loan subsidies not classified as investment spending (for example, administrative expenses related to grant and loan subsidy programs). For spending that the federal government does on its own account, includes outlays for all other noninvestment activities, including offsetting collections.[a]	*Current Operations:* Includes direct expenditures for compensation of state and local officers and employees and for supplies, materials, and contractual services.

Source: Definitions for federal outlays come from Office of Management and Budget, *Circular No. A-11: Preparation, Submission, and Execution of the Budget* (July 2010), Section 84, pp. 6–14. The capital outlays defined in this table represent the major types of federal physical investment and do not necessarily include all capital infrastructure described in this study. Definitions used by the Census Bureau for state and local expenditures can be found under codes F (Construction), G (Purchase of Land and Existing Structures), K (Purchase of Equipment) and E (Current Operations) at www.census.gov/govs/www/06classificationmanual/chapter05-2.html#p2c5table.51.

a. Offsetting collections are payments to the government that are credited to expenditure accounts and typically allow spending out of that account without an appropriation by the Congress. (Offsetting collections from the sale of physical assets are entered as negative amounts for the corresponding physical assets—that is, as negative outlays). This accounting mechanism is a residual balancing entry to ensure that the sum of all items in schedule C equals total budget authority and outlays net of offsetting collections. Includes transactions related to credit liquidating accounts.

local level, CBO adjusted data on annual state and local spending so that it conformed with the 12-month period spanned by the federal fiscal year. The public spending on infrastructure reported by this paper does not include interest payments or other financing costs.

Making Fiscal Years Conform. Most state governments and many localities observe a fiscal year that begins on July 1 and ends on June 30 of the following year.[15] The federal government followed that practice through fiscal year 1976. That fiscal year was followed by a transitional quarter, after which the federal fiscal year began on October 1. Starting in federal fiscal year 1977, that modification created a mismatch between the federal fiscal year

15. For details, see the latest publicly available technical documentation, available at www.census.gov/govs/www/06censustechdoc.html.

and the state and local fiscal years, which could cause errors in measuring state and local spending net of federal grant and loan subsidies for a particular year. To make state and local expenditures more comparable with federal outlays after 1976, CBO—following the methods used in its previous studies—adopted an alternative fiscal year for state and local governments that begins on October 1 and ends on September 30 of the following year. (Public spending on transportation and water infrastructure during that transitional quarter is reported in the detailed data provided on CBO's Web site as a supplement to this paper.)

For example, of the infrastructure expenditures reported for states and localities during fiscal year 2007 (which, as defined by this study, is constructed to run from October 1, 2006, to September 30, 2007), 75 percent come from the actual state and local fiscal year of 2007 (July 1, 2006, to June 30, 2007) and the remaining 25 percent come from the following state and local fiscal year (July 1, 2007, to June 30, 2008).

That procedure reduces potential errors—particularly in the sequencing of federal grants and loan subsidies and their use by states and localities—caused by the inexact match between the two types of fiscal years. However, it means that although expenditure data from the Census Bureau's survey of State and Local Finances run through state and local fiscal year 2008, those data allow a match with federal outlays only through 2007.

Costs as Financed Versus Current Resource Costs. CBO's estimates of infrastructure spending by the federal government and by state and local governments do not include payments of interest on debt issued to finance public infrastructure. The inclusion of interest payments would reflect the full capital cost of investment and thereby measure the costs of infrastructure as financed. By excluding interest payments, CBO was able to measure the current resource costs of infrastructure, which are the most appropriate gauge of infrastructure spending for analyses of how efficiently society currently chooses to allocate its resources. Costs as financed reflect the burden imposed on society as a result of past and current decisions (say, to obtain a given amount of infrastructure services over time).[16]

Data Sources

In most cases, CBO obtained data on federal infrastructure spending from OMB; when satisfactory information was not available, CBO relied on supplementary historical data reported with the President's budget request. For information on state and local infrastructure spending, CBO obtained data from the Census Bureau. When calculating state and local infrastructure spending that was funded solely by state and local governments, CBO subtracted the value of grants and loan subsidies provided by the federal government for infrastructure spending. CBO adjusted each series of data in order to express spending in real (or constant dollars) and to make fiscal years consistent across levels of government.

Federal Infrastructure Spending

CBO's estimates of federal infrastructure outlays from 1998 to 2009 were derived directly from data collected by OMB on schedule C. To identify federal infrastructure spending both for this study and for earlier studies, CBO relied heavily on the budget subfunction assigned to each federal account, which in turn is based on the primary purpose served by that program. The following are the most relevant budget subfunctions:

- Water Resources, 301;
- Ground Transportation, 401;
- Air Transportation, 402; and
- Water Transportation, 403.[17]

In a few instances, adjustments to OMB's schedule C data—based on information from the President's budget—were required. Additionally, to obtain a complete picture of federal infrastructure spending, it was necessary

16. See Congressional Budget Office, *Future Investment in Drinking Water and Wastewater Infrastructure* (November 2002). As part of its State and Local Finances series, the Census Bureau publishes data on interest payments by states and localities on debt issued for water and transit projects. See Census Bureau, *Federal, State and Local Governments: Government Finance and Employment Classification Manual,* Table 5.1: "Description of Character and Object Categories," available at www.census.gov/govs/www/06classificationmanual/chapter05-2.html#p2c5table51 and Table 5.2: "Function and Object Code Validity, by Level and Type of Government," available at www.census.gov/govs/www/06classificationmanual/chapter05-2.html#p2c5table52.

to augment or otherwise adjust OMB's data in the following categories:

- **Mass Transit.** Capital outlays reported on OMB's schedule C as grants to state and local governments for investment in mass transit have been distributed across capital and operation and maintenance categories each year on the basis of the way recipient mass transit systems reported that they had used that federal funding. That information is found in *2010 Public Transportation Fact Book, 61st Edition* (Washington, D.C.: American Public Transportation Association, April 2010), Appendix A (Historical Tables), Table 37 (Capital Funding Sources), and Table 41 (Operating Funding Sources), available at www.apta.com/.

- **Rail.** Capital outlays reported on OMB's schedule C for investment in Amtrak have been distributed across capital and operation and maintenance categories each year based on outlays reported, respectively, for the accounts "Capital and Debt Service Grants to the National Railroad Passenger Corporation" and "Operating Subsidy Grants to the National Railroad Passenger Corporation" as found in the *Budget of the United States Government: Appendix,* "Detailed Budget Estimates by Agency: Department of Transportation, Federal Railroad Administration," various years.

  Outlays for the Surface Transportation Board are assumed to apply entirely to federal rail spending.

- **Water Resources.** Spending for "Water Resources Investigations" by the U.S. Geological Survey are obligations as reported in *Budget of the United States Government, Appendix,* "Detailed Budget Estimates by Agency: Department of the Interior," various years.

- **Water Transportation.** The Coast Guard's operating expenses are expressed in the form of obligations and are taken from that program's account in the *Budget of the United States: Appendix, Department of Homeland Security* for the following activities: search and rescue; marine safety; aids to navigation; and ice-breaking operations.[18]

- **Water Supply and Wastewater Treatment.** Community Development Block (or Formula) Grants (CDBG) for this type of infrastructure are assumed to be purely capital spending in the form of program disbursements for "Water/Sewer Improvements" and are reported at www.hud.gov/offices/cpd/communitydevelopment/budget/disbursementreports/profiles/National_Expenditure_FY09.xls.

  Rural Community Advancement grants and loan subsidies for this infrastructure type are either obligations or outlays and are taken from the *Budget of the United States Government: Appendix,* "Detailed Budget Estimates by Agency: Department of Agriculture," various years.

  Spending for "Clean and Safe Water" by two programs of the Environmental Protection Agency—Science and Technology, and Environmental Programs and Management—is in the form of obligations, as reported in *Budget of the United States Government: Appendix,* "Detailed Budget Estimates by Agency: Environmental Protection Agency," various years.

CBO assembled most of the federal data for the 1980–1997 period from information collected by OMB on schedule C. In a few instances, OMB's data conflicted with those shown in various parts of the President's budget. In those cases, CBO used the data from the budget.

Before 1980, CBO primarily relied on historical data from OMB to calculate federal spending for infrastructure. OMB's historical data show federal outlays for individual budget accounts broken down into grant and nongrant spending.

17. See Office of Management and Budget, *Circular No. A-11: Preparation, Submission, and Execution of the Budget* (July 2010), Exhibit 79A, Section 79, p. 9. Additionally, some federal programs that fund infrastructure—notably water supply systems and wastewater treatment plants—are classified under budget subfunctions other than those listed above. For example, the State and Tribal Assistance Grants administered by the Environmental Protection Agency are classified in Subfunction 304 (Pollution Control and Abatement). For further discussion, see Government Accountability Office, *Freshwater Programs: Federal Agencies' Funding in the United States and Abroad,* GAO-05-253 (March 2005), available at www.gao.gov/new.items/d05253.pdf.

18. The Army Corps of Engineers' projects to support water navigation are included in the water resources category of infrastructure spending along with all other infrastructure spending by that agency.

The historical data did not separate outlays into capital expenditures and spending for operation and maintenance. CBO took the data on capital expenditures from the *Budget of the United States Government*, in particular the "Historical Tables," "Special Analyses," and "Appendix." Because of apparent inconsistencies in the principal sources of data, CBO gathered spending data for the aviation and rail categories from the federal budget's appendix and classified them by type of spending on an account-by-account basis.

State and Local Infrastructure Spending

CBO obtained all data on state and local expenditures from the Census Bureau's State and Local Government Finance series, which is available at www.census.gov/govs/estimate. To obtain state and local spending, net of federal grants and loan subsidies, CBO subtracted the value of federal grants and loans for each type of infrastructure from the corresponding level of total spending by states and localities.

The types of infrastructure described in this study—specifically as pertains to spending by states and localities—are defined below. Examples of what is included and excluded in each category are provided at the Internet address for each entry:

- **Highways and Roads**

  Highways: www.census.gov/govs/www/classfunc44.html.

  - **Definition:** Maintenance, operation, repair, and construction of nontoll highways, streets, roads, alleys, sidewalks, bridges, tunnels, ferry boats, viaducts, and related structures.

  Toll Roads: www.census.gov/govs/www/classfunc45.html.

  - **Definition:** Maintenance, operation, repair, and construction of highways, roads, bridges, ferries, and tunnels operated on a fee or toll basis.

- **Mass Transit**

  www.census.gov/govs/www/classfunc94.html.

  - **Definition:** Operation, maintenance, and construction of public mass transit systems, including subways, surface rail, and buses.

- **Aviation**

  www.census.gov/govs/www/classfunc01.html.

  - **Definition:** Provision, operation, construction, and support of airport facilities serving the public at large on a scheduled or unscheduled basis and the regulation of the airline industry.

- **Water Transportation**

  www.census.gov/govs/www/classfunc87.html.

  - **Definition:** Provision, construction, operation, maintenance, and support of public waterways and harbors, docks, wharves, and related marine terminal facilities and the regulation of the water transportation industry.

- **Water Supply and Wastewater Treatment**

  Water Supply: www.census.gov/govs/www/classfunc91.html.

  - **Definition:** Operation, maintenance, and construction of public water supply systems, including production, acquisition, and distribution of water to the general public or to other public or private utilities, for residential, commercial, and industrial use.

  Sewerage: www.census.gov/govs/www/classfunc80.html.

  - **Definition:** Provision, maintenance, and operation of sanitary and storm sewer systems and sewage disposal and treatment facilities.

The Bureau of the Census does not report state and local expenditures on freight rail (it places passenger rail in the mass transit category); and, after 1990, it has not reported water resource expenditures in a manner consistent with this study's definition. As a result, the public spending on water resources reported by this paper since 1991 does not include state and local expenditures on that infrastructure.

Data on current and historical infrastructure expenditures at the national and state level are available at www.census.gov/govs/estimate/. More detailed data, such as expenditures on capital and operation and maintenance for each type of infrastructure and by level of government, are available in the file "State by Level of Government—Public Use Format." Additional information is provided by Bureau of the Census, *Federal, State, and Local Governments: Government Finance, and Employment Classification Manual* (November 2000), available at www.census.gov/govs/classification/index.html.

Converting Nominal Spending into Real Spending

CBO's estimates of real (inflation-adjusted) infrastructure spending use price indexes from the Bureau of Economic Analysis (BEA) to convert current-dollar (or nominal) spending into constant-dollar (or real) values. Those calendar year indexes are modified to correspond to federal fiscal years by appropriately weighting index values in adjacent years:

- For public spending on infrastructure capital by the federal government or by state and local governments, price indexes reflect the cost of state and local investment in new structures and are taken from Tables 5.8.4A and 5.8.4B, "Price Indexes for Gross Government Fixed Investment by Type," available at www.bea.gov/national/nipaweb/SelectTable.asp?Selected=N#S5. Over 80 percent of federal outlays for infrastructure capital take the form of grants and loan subsidies to states and localities, which then spend those funds; additionally, over 80 percent of such spending on most of the types of infrastructure discussed in this study is for structures rather than for equipment.

- Because BEA's index values for infrastructure investment in 2009 had not been published when this paper's spending data were compiled, nominal spending was adjusted by applying the 2009 value of two other indexes—one from BEA and the other from the Bureau of Labor Statistics (BLS):

  - For highways, mass transit, rail, and aviation, the Producer Price Index that was reported by BLS for *Material and Supply Inputs to Highway and Street Construction*, available at www.bls.gov/data/.

  - For all other infrastructure categories, see the BEA price series *State and Local Gross Investment in Structures* found in Table 3.9.4: "Price Indexes for Government Consumption Expenditures and Gross Investment," available at www.bea.gov/national/nipaweb/SelectTable.asp?Selected=N#S5.

- For public spending on operation and maintenance, the price indexes are taken from Table 3.9.4: "Price Indexes for Government Consumption Expenditures and Gross Investment," available at www.bea.gov/national/nipaweb/SelectTable.asp?Selected=N#S5.

  The price index for state and local government consumption is applied to net spending on operation and maintenance by those levels of government and to operation and maintenance spending in the form of grants and loan subsidies by the federal government. The price index for federal consumption is applied to all other federal spending on operation and maintenance. Index values were available through 2009. ◆