CONGRESS OF THE UNITED STATES
CONGRESSIONAL BUDGET OFFICE

CBO

Using Public-Private Partnerships to Carry Out Highway Projects

JANUARY 2012

Pub. No. 4041

A

CBO

STUDY

Using Public-Private Partnerships to Carry Out Highway Projects

January 2012

The Congress of the United States ■ Congressional Budget Office

Preface

The demands on the network of public highways in the United States have increased rapidly since the initial authorization of the Interstate Highway System in 1956. Specifically, the number of vehicle miles traveled has quadrupled, and congestion within the system has grown. Currently, the federal government and state and local governments face calls for more and better highways but confront budgetary constraints in providing them. Some analysts have suggested that public-private partnerships might supply at least a portion of that capacity by providing additional financing for road projects and improving the efficiency of a highway's construction and operation over the life of the road.

This Congressional Budget Office (CBO) study, which was prepared at the request of the Chairman of the Senate Committee on the Budget, assesses the role of public-private partnerships in providing highway infrastructure. In particular, the study focuses on whether such partnerships might provide additional financing for highways and build them more quickly or at a lower cost. In keeping with CBO's mandate to provide objective, impartial analysis, the report contains no recommendations.

The study was written by Alan van der Hilst of CBO's Microeconomic Studies Division under the supervision of Joseph Kile and David Moore (formerly of CBO). Perry Beider, Sheila Campbell, Wendy Kiska, Damien Moore, Nathan Musick, Sarah Puro, Felix Reichling, and Chad Shirley, all of CBO, provided helpful comments, as did Eduardo Engel of Yale University, R. Richard Geddes of Cornell University, David Lewis of HDR Inc., Deborah Lucas of the Massachusetts Institute of Technology, and Robert Poole of the Reason Foundation. (The assistance of external reviewers implies no responsibility for the final product, which rests solely with CBO.)

Leah Mazade edited the study, and Loretta Lettner proofread it. Jeanine Rees prepared the report for publication, and Maureen Costantino took the cover photo and designed the cover. Monte Ruffin printed the initial copies, and Linda Schimmel coordinated the print distribution. The study is available on CBO's Web site (www.cbo.gov).

Douglas W. Elmendorf
Director

January 2012

Contents

Summary *vii*

1

Approaches to Providing Highways *1*
The Traditional Approach *2*
Public-Private Partnerships *3*

2

Private Financing of Highways *9*
The Availability of Financing *9*
Measuring the Cost of Financing *10*
How Financing Can Affect Participants' Incentives *12*
Experience with Private Financing of Highway Projects *12*

3

Private Provision of Highways *19*
Managing Risks Through Contracts *19*
Experience with Public-Private Partnerships for Highway Projects *22*

A

Public-Private Partnerships in Other Countries *27*

B

Two Case Studies of Long-Term Lease Agreements for Highway Operations and Maintenance *29*

Tables

1-1. Stages and Types of Activities Involved in Providing Highways *3*

1-2. Value of Contracts Covering Public-Private Partnerships for Highway Projects, January 1989 to June 2011 *4*

2-1. Completed Highway Projects That Used Public-Private Partnerships with Private Financing *14*

2-2. Ongoing Highway Projects That Use Public-Private Partnerships with Private Financing *16*

Figures

1-1. Miles of Public Roads in the United States and Vehicle Miles Traveled, 1960 to 2009 *2*

B-1. Public Versus Private Costs per Lane Mile to Operate and Maintain the Chicago Skyway *30*

B-2. Operations and Maintenance Costs per Lane Mile for the Indiana Toll Road and Selected State Turnpikes *31*

Box

1-1. Deciding Whether to Undertake Public-Private Partnerships *6*

Summary

The United States has a network of over 4 million miles of public roads. That system has faced increasing demands over time: The number of vehicle miles traveled (both passenger and commercial) rose from approximately 700 billion in 1960 to just under 3 trillion in 2009. In 2010, the federal government and state and local governments spent about $160 billion to build, operate, and maintain roads. (This study adopts the practice of the Federal Highway Administration in using the words "highway" and "road" synonymously.) Almost all of those infrastructure projects were undertaken using a traditional approach in which a state or local government assumes most of the responsibility for carrying out a project and bears most of its risks, such as the possibility of cost overruns, delays in the construction schedule, and, in the case of toll roads, shortfalls in the road's revenues. Some observers assert that an alternative approach, using a public-private partnership, could increase the money available for highway projects and complete the work more quickly or at a lower cost than is possible through the traditional method. Specifically, such a partnership could secure financing for a project through private sources that might require more accountability and could assign greater responsibility to private firms for carrying out the work. For example, a private business might take on the responsibility for specific tasks, such as operations and maintenance, and their accompanying risks.

In this study, the Congressional Budget Office (CBO) finds that private financing will increase the availability of funds for highway construction only in cases in which states or localities have chosen to restrict their spending by imposing legal constraints or budgetary limits on themselves. The reason is that revenues from the users of roads and from taxpayers are the ultimate source of money for highways, regardless of the financing mechanism chosen. The cost of financing a highway project privately is roughly equal to the cost of financing it publicly after factoring in the costs associated with the risk of losses from the project, which taxpayers ultimately bear, and the financial transfers made by the federal government to states and localities. Any remaining difference between the cost of public versus private financing for a project will stem from the effects of incentives and conditions established in the contracts that govern public-private partnerships.

CBO also finds, on the basis of evidence from a small number of studies, that such partnerships have built highways slightly less expensively and slightly more quickly, compared with the traditional public-sector approach. The relative scarcity of data on public-private partnerships for highway projects, however, and the uncertainty surrounding the results from the available studies make it difficult to apply their conclusions definitively to other such projects.

Approaches to Providing Highways

The traditional approach to providing roads, known as the design-bid-build approach, is used nearly uniformly across the United States. It is mainly a public-sector endeavor, in which state or local governments pay for projects with some combination of their own funds, funds provided by the federal government, and borrowed funds that are ultimately repaid by revenues from taxes or tolls. Once funds are secured, a public manager—generally a state department of transportation or other public authority—either designs the highway project itself or contracts with a private firm to design it. A different private entity, which is usually selected on the basis of the lowest-cost bid, then carries out the project. A public agency manages the longer-term operations and maintenance of the highway, although that public entity may, again, contract with a private firm to perform some of those tasks.

Under the traditional approach to highway projects, private firms that have signed contracts to construct a road or perform other project-related tasks take on only a limited amount of risk. For example, they retain the ability to pass on to the public agency any increase in their costs as a result of unforeseen changes in the scope or details of the project, a feature of the traditional approach that increases the chances that the private firm's costs will exceed its bid price. For its part, the public sector retains a high degree of control over the highway during its useful life.

The term "public-private partnership" refers to a variety of alternative arrangements for highway projects that transfer more of the risk associated with and control of a project to a private partner. That transfer is achieved in part by bundling some of the elements of providing a highway. Among the most extensive public-private partnerships are those in which a private firm provides financing for a highway project, designs and builds it, and then, in exchange for the right to charge tolls, operates and maintains it over its useful life. The most common type of public-private partnership, however, is the more limited "design-build" agreement in which one contractor agrees to both design and build a highway rather than having the public sector manage each of those steps independently.

In a partnership, the contractor assumes greater risks than it would under the traditional approach because the terms of the partnership's contract generally limit the private firm's ability to renegotiate the contract in the event of higher costs. Nevertheless, that advantage to the public sector of transferring the risk and control of a project to a private firm may have a downside: It may limit the government's ability to respond to changing conditions or to achieve other objectives that might improve the welfare of the state's or locality's citizens but reduce the private partner's profits.

The use of such partnerships for providing highway infrastructure is limited in the United States. Between 1989 and 2011, the value of contracts for all projects whose costs exceeded $50 million was only about $41 billion, representing a little more than 1 percent of the approximately $3 trillion (in 2010 dollars) that was spent on highways during that period by all levels of government. The use of public-private partnerships is increasing, however, and by one estimate accounted for between 30 percent and 40 percent of all new miles of urban limited-access highways built between 1996 and 2006.[1] This study addresses the potential role of the private sector in two aspects of building highways: the financing of projects and the provision (that is, the design, construction, operation, and maintenance) of highways.

Private Financing of Highways

Most highway projects are paid for with current state or federal revenues and are not financed through borrowing. But sometimes a project is large enough that the state or local government, or other public authority, must borrow money to move the project forward. When that is the case, the public entity can provide financing either through traditional public borrowing—by issuing government bonds, on which investors are generally willing to accept a relatively low rate of return because the bonds are backed by the taxing authority of the public entity—or by joining with a private partner to obtain private financing. Private financing can provide the capital necessary to build a new road, but it comes with the expectation of a future return, the ultimate source of which is either taxes or tolls.

The total cost of the capital for a highway project, whether that capital is obtained through a government or through a public-private partnership, tends to be similar once all relevant costs are taken into account. In general, the overall rate of return demanded by investors depends on their perception of the risk of losses associated with the project. A construction project is never without such risk, even when a government guarantees repayment of any debts incurred to finance construction. Someone always bears that risk: That is, some form of explicit or implicit equity investment is necessary to absorb potential cost overruns or revenue shortfalls.[2] For highways that are financed by public debt, taxpayers play the role of equity investors, bearing the risk that revenues might be less (or more) than the payments that have been promised

1. Urban limited-access highways exclude rural and suburban roads, where tolls are unlikely to yield sufficient revenues, and roads that have lower traveling speeds and numerous intersections, where toll operations would be more difficult and costly.

2. Equity and, more specifically, equity investments refer to the funds provided by the class of investors that, after all liabilities are discharged, is the last to receive payments in the event of a default or bankruptcy. Those investors bear the greatest risk of not receiving a return on their investment and therefore invest only when they expect a rate of return large enough to compensate them for that added risk.

on the debt. A comprehensive measure of the cost of financing a highway project will account for the cost of both equity and debt financing, even when the equity is provided indirectly by taxpayers.

The choice between public and private financing may affect the incentives to manage the project efficiently and hence the project's costs and schedule. Private investors who make equity investments receive payments only after all other claimants to the project's revenues (such as holders of debt, suppliers, and workers) have received what is owed them; those equity investors thus have an incentive to minimize costs and delays if they are granted control over the project. Debt holders generally are not given such control and have little incentive to work to improve how the project is carried out because they are insulated from the effects of most cost overruns and other risks. By itself, however, the incentive to control costs and meet schedules is not sufficient to guarantee the project's effective execution. In cases in which private financiers have limited control, they may not be able to influence the efficiency with which the project is carried out.

How a project is financed may also affect who bears its costs. Financing a project with bonds whose interest is exempt from federal taxation or with funds that reflect other subsidies from the federal government shifts the project's costs from state taxpayers to federal taxpayers. It does not, however, reduce the total cost of the project's financing.

To date, investors in the small number of public-private partnerships that have financed and built highways in the United States have in most cases overestimated the toll receipts from the completed roads. Thus, the projects have not produced large enough returns to justify those investments. Such a record is evidence that those investors assumed significant risk in that they built the highways and did not receive the payments they expected. Their losses may explain why more-recent partnership agreements for highway projects have reduced the private partners' exposure to the risk of lower-than-expected toll revenues by guaranteeing payments (from the public partners) regardless of how much the roads are used. In addition, more-recent agreements have reduced private partners' debt-service payments—that is, interest payments on any money borrowed to finance the projects—by increasing the share of financing provided by the state or locality or by the federal government. Accordingly, financing provided by the federal TIFIA (Transportation Infrastructure Finance and Innovation Act) program and tax-exempt private activity bonds issued by municipalities (to finance projects of private users) have become increasingly prominent sources of funds for highway projects.

Private Provision of Highways

If a public-private partnership arrangement is chosen for a highway project, the government involved must design, implement, and monitor contracts that allocate risk and control between the public and private partners. Although contracts of that kind are difficult to create because the parties involved cannot anticipate all contingencies, they are essential to establishing the right incentives to perform the work efficiently and manage the project's associated risks. In particular, they may help reduce the total cost of the project by bundling tasks that under the traditional approach would be performed by separate entities.

A drawback of a partnership arrangement for the public sector, however, can be its loss of control of a project. Contracts for public-private partnerships may in some cases turn over some toll-setting authority to the private sector. Higher tolls are likely to result, an outcome that may conflict with other public-sector goals. A loss of control may also lead to conflicts about and renegotiations of the terms of the contract, which may be costly for the public sector. More generally, less control of a project by the public partner over the long run may make attainment of the government's future objectives more costly; it may also complicate efforts to adhere to a contract written many years—or even decades—earlier and still protect the public's interests.

Assessments of whether public-private partnerships can provide highway infrastructure more efficiently than traditional methods are challenging, in large part because of limited data and research. Only a few studies have focused on the private provision of a highway project—that is, on design and construction as well as on operations and maintenance. That research found that the use of the design-build type of public-private partnership slightly reduced the cost of building highways relative to the cost under the traditional approach and slightly reduced the amount of time required to complete the projects. The studies typically estimated that the cost of building roads through design-build partnerships was a few percentage points lower than it would have been for

comparable roads provided in the traditional way. (However, estimates of such savings are quite uncertain, and the effect on costs of using design-build arrangements in the future could differ significantly from what the estimates in those studies imply.) Moreover, under such partnerships, many of the roads were built more quickly. Studies found that for projects with contracts valued at more than $100 million, the total time required to design and build the road declined by as much as a year on some projects—in part because the public-private partnership bundled the design and construction contracts and so eliminated a second, separate bidding process for the additional tasks.

Information about using public-private partnerships to operate and maintain roads is limited. In recent years, two older highways built in the traditional way, the Chicago Skyway and the Indiana Toll Road, have been converted to private management, making them subject to control by the private sector. Comparing the cost of operations and maintenance for those highways under public and private management indicates that both roads experienced reductions in costs after a private firm assumed control. A variety of factors in addition to the transfer of control, such as the recent recession and the associated reduction in traffic, probably contributed to that result.

CHAPTER

1

Approaches to Providing Highways

The United States has a network of over 4 million miles of public highways, according to the Federal Highway Administration (FHWA).[1] Those roads are used to move individuals and transport freight throughout the country and thereby play a key role in people's lives and in the economy. (This study follows the FHWA's practice of using the words "roads" and "highways" synonymously.) Over time, the demands on the highway system have increased. Since 1960, the total number of miles traveled by commercial and personal vehicles has quadrupled, rising from 718 billion in 1960 to just under 3 trillion in 2009, an average increase of about 3 percent per year.[2] During the same period, the highway network has grown more slowly, expanding from 3.5 million miles in 1960 to 4.1 million miles in 2009, an average increase of about 0.3 percent per year (see Figure 1-1). The increase in vehicle miles traveled relative to the number of miles of public roads has led to more congestion and renewed interest in expanding the capacity of the highway system.

In the United States, highway projects are carried out primarily by governments and paid for by taxpayers and users. Such projects include the building, widening, and resurfacing of roads as well as the construction and rehabilitation of bridges and tunnels. In some cases, private firms may carry out those projects as contractors on behalf of the public sector. However, state and local governments typically determine which projects to undertake and how much to spend on them, although the federal government may influence those decisions through the funds it provides for certain types of projects. In 2010, those governments together spent an estimated $160 billion to build, operate, and maintain roads; the federal government's share amounted to about one-quarter of that amount.[3] (Data on actual spending in that year by state and local governments are not yet available.)

Other than as contractors, private firms have played only a very small role in the provision of highways, for several reasons:

- Highways display, at least to some degree, characteristics of "public goods." Usually, such goods are not profitable for the private sector to provide because once they have been built, it can be difficult and costly to keep consumers from using them or to charge for their use. In addition, the use of a public good by one consumer may not alter the benefits it can provide to another consumer.

- It is not practical to have competing networks of roads because they are costly to build although relatively inexpensive to operate and maintain. In many instances of such "natural monopolies," governments directly provide the goods or services or closely regulate the providers.

- The benefits of a highway—for instance, in promoting commerce—may extend beyond the place where it is built and beyond the people who travel on it. However, because private firms cannot easily charge for such benefits, the private sector often ignores them in deciding whether to invest in particular projects.

Budgetary constraints at all levels of government in recent years have sparked interest in the use of new—that is,

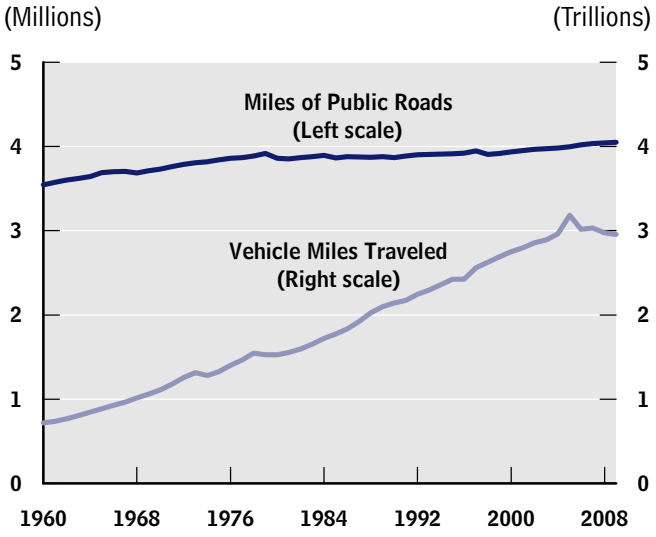
1. Department of Transportation, Federal Highway Administration and Federal Transit Administration, *2008 Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance—Report to Congress*, www.fhwa.dot.gov/policy/2008cpr/pdfs/cp2008.pdf.

2. Department of Transportation, Federal Highway Administration, *Highway Statistics Series* (various years), www.fhwa.dot.gov/policyinformation/quickfinddata/qftravel.cfm.

3. For more information on that spending, see Congressional Budget Office, *Public Spending on Transportation and Water Infrastructure* (November 2010).

Figure 1-1.

Miles of Public Roads in the United States and Vehicle Miles Traveled, 1960 to 2009



Source: Congressional Budget Office based on data from the Federal Highway Administration.

private—sources of financing and control of highway projects. In particular, some observers have suggested that public-private partnerships—in which private firms take on joint responsibility with governments for several elements of the projects, such as design and construction or operations and maintenance—might increase the resources available for financing roads. Similarly, they have argued that additional private involvement will make the projects more efficient by allowing them to be completed more quickly or at a lower cost. This Congressional Budget Office (CBO) study assesses those claims by addressing two main issues: whether public-private partnerships can increase the amount of financing available for highway projects (discussed in Chapter 2) and whether such partnerships can provide highways more efficiently than the traditional public-sector approach (examined in Chapter 3).

The Traditional Approach

Highway projects comprise five major stages of activity—typically referred to as design, build, finance, operate, and maintain—that either the public or the private sector can carry out (see Table 1-1). The traditional approach to such projects, sometimes called the design-bid-build method, is the most common means used to provide highways in the United States.[4] Under that approach, a government agency—for example, a state department of transportation or other public authority—may design the highway, provided that the agency has the necessary experience and capabilities, or it may contract with a private company for such services. In most cases, the agency then contracts with a different private business, chosen through a bidding process, to construct the road. Subsequently, the public agency is responsible for operating and maintaining the highway, although, again, many state and local governments contract with private businesses for those purposes.

Under the traditional approach to providing highway infrastructure, the public sector manages the project and bears nearly all of the risks associated with it. Most contracts for highway projects provide for payments based on the contractor's costs rather than on a fixed price; as a result, governments retain the risk of cost overruns, delays in the construction schedule, problems with the quality of the design or with the road's construction, and, in the case of toll roads, shortfalls in the road's revenues. Correspondingly, contractors have only limited control over the characteristics of a project—for example, the design of a bridge or the depth of a road's pavement—and the public agency retains the right to make changes to such features even after work has begun. In such instances, contractors typically do not bear the risk of an increase in their costs from the changes but instead pass on the increase to the public agency.

For highway projects carried out through the traditional approach, the federal government and state and local governments provide financing from a variety of sources. The funds that the federal government allocates to highway projects come primarily from taxes on gasoline and diesel fuel (18.3 cents and 24.3 cents per gallon, respectively). Receipts from those taxes and from others, such as taxes on truck tires and on motor vehicles heavier than 55,000 pounds (which cause the most damage to highways), are credited to the Highway Trust Fund, an

4. In the early years of the 20th century, federal law required that each phase of a highway project be carried out through a separate contract. In the ensuing decades, state and local governments took up that approach, and it became the nearly universal method of providing highways in the United States.

Table 1-1.

Stages and Types of Activities Involved in Providing Highways

Stage	Activities
Design	Completing plans for the project, which includes producing architectural drawings and selecting construction materials and the construction site.
Build	Constructing the road, which includes reviewing conditions at the building site, providing construction staff and materials, selecting equipment, and, when necessary, amending the design to address problems discovered during the construction phase.
Finance	Providing capital for the project, which may include issuing debt or equity and verifying the feasibility of plans for repaying debt or providing returns on investment.
Operate	Ensuring the continuing performance and availability of the highway, which includes removing debris and snow and collecting tolls and data on traffic.
Maintain	Keeping the project in a state of good repair, which includes filling potholes, repaving or rebuilding roadways, and ensuring the integrity of bridges and highways.

Source: Congressional Budget Office.

account in the federal budget that tracks certain highway-related revenues and expenditures.[5] Since 2008, however, those tax receipts have not been sufficient to cover spending from the trust fund, and lawmakers have supplemented them with an additional $34.5 billion in other funds from the Treasury.[6]

States (and, in some cases, localities) combine federal funds with their own to pay for highway projects.[7] States differ in the types of funds they use for highways and how they determine which projects they will carry out. All states collect revenues from gasoline taxes, which range from 8 cents per gallon in Alaska to about 50 cents per gallon in California. (The average state and local gasoline tax is 31 cents per gallon.)[8] Some states also use vehicle license fees, highway tolls, and other taxes (such as driver's license fees) to pay for highway projects. Whenever current revenues are insufficient to finance the construction of new roads, as is often the case for large projects, states finance that construction through borrowing—specifically, by issuing bonds. Repayment of that debt is typically backed by states' general revenues, although in some instances, tolls or other kinds of revenues may be used unless a state's laws prohibit that approach.

Public-Private Partnerships

In public-private partnerships, the role of and the risk borne by private firms are greater than they are under the traditional approach. Such arrangements bundle certain elements of the project (for example, financing, operations, and maintenance) and transfer responsibility for implementing them, together with the risks those tasks entail, to a private partner; the partner then receives compensation in the form of direct payments from the public

5. For additional details, see Congressional Budget Office, *Alternative Approaches to Funding Highways* (March 2011).

6. Government Accountability Office, *Highway Trust Fund: Nearly All States Received More Funding Than They Contributed in Highway Taxes Since 2005*, GAO-10-780 (June 2010), www.gao.gov/new.items/d10780.pdf.

7. Under the Federal-Aid Highway program, most of the federal money provided to states must be matched by money from state or local governments—typically at a 20 percent matching rate. (For each dollar of highway spending, at least 20 percent must be from state or local sources; 80 percent at most comes from the federal government.) In some instances, such as for safety programs, the matching rate for states is lower than 20 percent.

8. CBO's calculation of that average is based on American Petroleum Institute (API), "Gasoline Taxes: Combined Local, State, and Federal (Cents per Gallon)" (May 2011). The institute's estimate of the average tax per gallon in each state includes the federal tax of about 18 cents per gallon; CBO excluded that amount in calculating the average. API's estimate also includes gasoline taxes, sales taxes, and other levies imposed by state or local governments. Taxes on gasoline are calculated on a cents-per-gallon basis. Sales taxes and other levies, which are calculated as a percentage of the purchase price, were converted by API to a cents-per-gallon basis.

Table 1-2.

Value of Contracts Covering Public-Private Partnerships for Highway Projects, January 1989 to June 2011

(Billions of 2010 dollars)

	Value of Contract
	Design-Build Projects[a] (Number: 55)
All Projects	25.0
Average	0.5
Largest Projects	
I-15 Reconstruction (Utah)	1.8
State Highway 130, Segments 1 to 4 (Texas)	1.6
Alaska Way Viaduct (Washington)	1.4
	Design-Build-Finance Projects (Number: 11)
All Projects	3.1
Average	0.3
Largest Projects	
I-75 Collier/Lee County (Florida)	0.5
Route 3 North (Massachusetts)	0.5
I-75 iROX (Florida)	0.4
	Design-Build-Finance-Operate-Maintain Projects (Number: 10)
All Projects	12.7
Average	1.3
Largest Projects	
I-635 LBJ Freeway (Texas)	2.6
North Tarrant Express (Texas)	2.1
I-495 HOT Lanes (Virginia)	2.0
	Total Public-Private Projects (Number: 76)
All Projects	40.8
Average	0.5

Source: Congressional Budget Office based on "U.S. Transportation P3 Projects, 1989–2011," *Public Works Financing*, vol. 261 (June 2011), pp. 22–24.

Notes: Only projects with a value greater than $50 million are included in the table.

iROX = interstate roadway expansion; HOT = high occupancy/toll.

a. Covers projects with and without a warranty in which the contractor guarantees the integrity and quality of the finished product.

sector—usually a state government—or the right to collect tolls. In accepting those risks, the private partner expects that the compensation it has been promised will be sufficient to provide a rate of return on its investment that is as good as or better than the rate it would receive from alternative investments.

Some observers apply the term "public-private partnerships" only to projects that include capital from private sources. For this study, however, CBO has adopted a broader definition of the term to include any contractual arrangement that transfers more risk from the public sector to the private sector than is the case under the traditional (design-bid-build) approach. That definition allows consideration of potential increases in efficiency from the private sector's involvement in ways that do not include private financing.

Three main types of public-private partnerships have been used for highway projects in the United States:

- **Design-build projects,** the most common type of public-private partnership, are set up as fixed-price contracts between one private entity and a public agency to jointly manage the design and construction of a new road. Under such an arrangement, the private party accepts most or all of the risk of increases in costs associated with the project.[9] Financing comes from tax revenues or tolls, and the public partner retains ownership of the highway and control of its financing, operations, and maintenance. According to *Public Works Financing*, a monthly newsletter that has reported on public-private partnerships for roughly 25 years, private firms and government agencies jointly undertook 55 design-build projects with a value of $50 million or more between July 1989 and June 2011 (see Table 1-2).[10]

9. In some projects, the private partner also provides a warranty guaranteeing the integrity and quality of the finished product.

10. See "U.S. and Canadian Transportation Projects Scorecard," *Public Works Financing* (June 2011). The scorecard reports only projects whose value exceeds $50 million.

- The same type of contract that is used for a design-build effort can be used in a **design-build-finance** arrangement except that in this case, the private partner provides the necessary up-front capital and is generally repaid through tolls or by a state or local government in a series of installments. Between July 1989 and June 2011, public-private partnerships undertook 11 design-build-finance projects with a value of $50 million or more.

- The broadest private role encompasses the elements of the design-build-finance structure but also includes operations and maintenance performed by private firms. Those types of partnerships, known as **design-build-finance-operate-maintain** arrangements, use the same kind of contract as that used for design-build-finance projects except that in this case, the private partner agrees to perform operations (such as the removal of snow and debris and the collection of tolls) and carry out maintenance on the highway for a specific period. The contract spells out how the private partner is to be repaid for up-front and ongoing expenses through future tolls or other fees imposed on users of the road or through "availability payments" from state or local governments, which are financed by receipts from income or other taxes that are not linked to the use of the road. (Such projects may also be called **build-own-operate-transfer** partnerships because the private partner initially builds and owns the road but then transfers ownership to the public partner.) Between July 1989 and June 2011, public-private partnerships undertook 10 privately financed projects with a value of $50 million or more involving private responsibility for operations and maintenance.

The type of organization that serves as the private partner in a public-private partnership varies widely depending on the size of the project and the scope of the private sector's role. For design-build public-private partnerships, the private partner in many cases is a joint venture between a design firm and one or more construction firms; occasionally, one firm provides both services. In many partnerships that include private financing, those joint-venture entities contract with banks or other private lenders to provide capital. For highway projects that include operations and maintenance, the private partner is generally a consortium of firms, led by a project development and management company that in many instances is a large multinational corporation. That company delegates such tasks as construction, operations, and maintenance to subsidiary firms or other parties and bears most of the risks associated with the project.

When a public-private partnership is in place, the private partner has a greater incentive to manage any risk that it bears—such as the chance that aspects of the project will be more expensive than it had anticipated—because it cannot pass the costs on to the public partner. In return for bearing that additional risk, the private firm requires more control over the project; it also has an incentive to expend more effort in controlling costs and avoiding delays in the schedule than it would have as a contractor working under the traditional approach. (See Box 1-1 for a discussion of ways to evaluate the efficacy of using a public-private partnership.)

Public-private partnerships have a greater chance of being successful if the public partner can foster substantial competition among private firms for the partnership contracts. Competition among firms, through a bidding process to receive a contract for the right to serve a market, for example, conveys many of the same advantages (such as lower prices) that may accompany competition among multiple firms in any market. In particular, competition among firms for contracts for highway projects encourages those businesses with a "production advantage"—for example, those with the greatest capability to carry out the bundled tasks that are part of the project—to offer a bid that shares any possible benefits of a partnership arrangement (such as lower costs) with the public partner or risk losing the bid.[11]

The use of public-private partnerships for highway projects has become more widespread in the United States in recent years, but other countries have been using the approach regularly for such projects for at least the past 20 years (see Appendix A). In the United States, state and local governments have also used public-private partnerships for other kinds of infrastructure projects—for example, for public buildings, such as schools, hospitals, and prisons; rail systems; and water and wastewater projects. Between 1985 and 2010, the value of the contracts for those U.S. projects totaled about $36 billion (in 2010 dollars), an amount similar to the value of contracts

11. R. Richard Geddes, *The Road to Renewal: Private Investment in U.S. Transportation Infrastructure* (Washington, D.C.: AEI Press, 2011), p. 54.

Box 1-1.

Deciding Whether to Undertake Public-Private Partnerships

A government that embarks on a highway project faces a choice between the traditional approach, in which a state or local government assumes most of the responsibility for carrying out the project and bears most of its risks (for example, of cost overruns), and an alternative method such as a public-private partnership, which may secure financing for a project through private sources and require a private firm to assume greater responsibility than under the traditional approach for carrying out the work. For a public-private partnership to be successful, the public and private partners should both be better off having entered the partnership than they would have been if they had chosen an alternative approach or project. In practice, that means that the private partner receives a return from its investment in the project that is better than the return from other potential investments carrying similar risks; it also means that the public partner procures the highway more quickly, more cheaply, or with less risk than it would by using the traditional approach and still meets its other goals. The path to those outcomes is laid out in the partnership contract, which allocates the project's risks and responsibilities to the various partners.

To decide whether to undertake a public-private partnership, some states have used a public-sector comparator (PSC). A PSC is a process for estimating the full cost of providing a highway in the traditional manner, which a state can then use as a basis of comparison with the cost of providing it through alternative methods. The PSC involves calculating the net present value of the costs for the road during its entire life cycle—an approach that includes assigning explicit costs to the risks associated with the project (for example, the risk of unforeseen conditions at the highway site), which the traditional method of estimating a project's costs often ignores.[1] That can be a complicated process: Projected costs must be estimated and discounted to provide a calculation that is comparable for the traditional and alternative approaches. When implemented correctly, a PSC aids in evaluating the potential efficacy of a public-private partnership. It can also be used to test the financial viability of the project beforehand, eliminating from consideration projects whose revenues would be insufficient to attract a private partner.

Gathering data for a PSC can be costly and time-consuming, however—taking as long as several months, depending on the specifics of the project, and sometimes requiring the help of outside experts.[2] As a result, states and local governments do not always make use of such a tool. Estimating the cost of a highway relatively early in a project's development requires many assumptions to be made and makes the

1. The present 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. PSCs are discussed in Organisation for Economic Co-operation and Development (OECD), "The Economics of Public-Private Partnerships: Is the PPP Route the Best Alternative?" in *Public-Private Partnerships: In Pursuit of Risk Sharing and Value for Money* (Paris: OECD, 2008), p. 72.

2. Kevin Davis, "PPPs and Infrastructure Investment," *Australian Economic Review*, vol. 38, no. 4 (December 2005), pp. 439–444.

Continued

Box 1-1. **Continued**

Deciding Whether to Undertake Public-Private Partnerships

process more complex, costly, and uncertain than it would be if the calculations were done later, when more information (such as the bids submitted for carrying out the project) was available. But if the estimated cost of providing the highway is calculated later in the development process, and if the conclusion reached from the PSC is different from the initial choice for managing the highway project, then some expenses (such as those associated with analyzing the project and formulating proposals) would already have been incurred and could not be recouped. Given the extra expenses associated with implementing a PSC, its use seems to be more cost-effective with larger projects than with smaller ones.

In addition, the calculations involved in a PSC are not always straightforward, and errors are possible. For example, the agency might choose an incorrect discount rate for future costs, which could lead to misleading conclusions. The agency might also mistakenly exclude or poorly measure the cost of certain risks or double-count some benefits (such as a savings in time) or costs. Although tools such as the PSC can help guide decisions, their results are sensitive to a variety of assumptions about the project (for example, which partner bears certain risks and the transferability of risk between partners), which makes sensitivity analyses particularly valuable. Thus, if a certain type of risk is hard to measure and the results of a completed PSC suggest that a particular type of approach to a project is preferable, a sensitivity analysis can show whether that outcome (which type of approach is preferable) changes when different estimates of that risk are used.

But assessing which approach is preferable for a project does not necessarily indicate whether the project itself is worthwhile or more worthwhile than alternative projects. That judgment requires measuring the benefits and costs of a project, evaluating not only its local effects but also its effects across the entire highway network. The broader focus of a benefit-cost analysis can be an advantage. A criticism of public-private partnerships is that they will be most applicable to projects with the greatest potential for profit, not necessarily those of the greatest social value. If decisionmakers relied too heavily on profitability as a criterion and by extension on public-private partnerships to execute infrastructure projects, they might select only profitable projects and ignore those that could deliver broader benefits for the highway network or the economy.

Even so, benefit-cost analyses of highway projects have drawbacks as well and are little used by states and local governments except for large or otherwise prominent projects. In particular, they require a substantial amount of information that is difficult to gather, especially that concerning a project's potential benefits for the private sector and for society over long periods. Much of that information may be unavailable or difficult to develop. But even in cases in which relevant data exist, the estimates produced from those data are necessarily uncertain because even small changes in demographics and patterns of travel can significantly affect such findings.

for public-private partnerships for highways during that period.[12]

The number and costs of the public-private partnerships used in the United States during that period have varied by the type of infrastructure involved. The most common application of the public-private approach has been in the construction of buildings, including schools, courthouses, and corrections facilities. Since 1985, 158 of those projects have been undertaken as public-private partnerships, with an average contract value of just under $60 million. Measured in terms of costs, contracts for partnerships for transit and rail projects have generally been larger than partnerships for projects in other categories of infrastructure: From January 1985 to October 2010, 20 rail projects were undertaken as public-private partnerships with contracts averaging slightly more than $660 million each. Water and wastewater projects—141 projects over the period—involved smaller contracts, averaging about $100 million.

12. "2010 Roads, Rail, Water, Buildings PPPs by Region (Cumulative Since 1985)," *Public Works Financing* (October 2010), p. 2.

CHAPTER

2

Private Financing of Highways

Under the traditional approach to highway projects, a state or local government uses some combination of its own tax receipts, any federal grants that it receives, and money that it borrows—usually by issuing bonds—to provide financing for a road. In contrast, a public-private partnership that includes private financing borrows money in private capital markets or raises equity from investors, with the expectation that the project's revenues, provided either by a state or local government or through tolls on the road, will cover the project's costs.[1] Those costs include a competitive rate of return to the holders of debt and equity—that is, a rate of return as good as or better than what those investors could receive on alternative investments of comparable risk.

The case is sometimes made that using funds from private capital markets to finance roads can increase the resources available to build, operate, and maintain roads. But the sources of revenues available to pay for the cost of a highway project—whether it uses the traditional financing approach or a public-private partnership—are the same: specifically, tolls paid by users or taxes collected by either the federal government or by state and local governments. Therefore, absent restrictions on governments' ability to borrow, there is no difference between the amount those governments could raise themselves and the sums that public-private partnerships could raise because the same resources are available to remunerate investors in either case. Even so, the type of financing used for a project can affect the cost of obtaining that financing as well as the total expenditures on the road.

1. Equity and, more specifically, equity investments refer to the funds provided by the class of investors that, in the event of the project's default and only after all liabilities are discharged, is the last to receive payments. Those investors bear the greatest risk of not receiving a return on their investment and therefore only invest when they expect a rate of return large enough to compensate them for that added risk.

In order to properly assess the difference in costs between securing financing through the traditional approach (generally as public debt) and obtaining it by private means, it is necessary to account not only for the interest paid on money borrowed for the project but also for the costs associated with the risks borne by taxpayers and the costs of financial transfers—in the form of subsidized interest rates and advantageous tax treatment—from the federal government to states and localities. If such a comprehensive measure is used, the costs of private and public financing are roughly comparable.[2] Any differences in costs, then, between traditional and private financing would stem from the impact of incentives and specific conditions in the contract governing a project, factors that would affect the actions and decisions of both public agencies and private firms.

The Availability of Financing

Private financing is unlikely to increase the availability of funds for highway projects because revenues from taxpayers and from users of the highway are the source of repayment regardless of the financing mechanism chosen for the project. However, in some cases, private financing could allow states and localities to overcome certain legal constraints and budgetary practices that may restrict their ability to carry out such projects. Many of those governments have statutory or constitutional limits on how much they can borrow. Although some of those limits are informal or easily bypassed, others are enforced more stringently by, for example, restricting the amount of debt that a state may incur without the approval of voters or requiring a supermajority in the legislature to bypass the limit. The state of Maryland, for example, uses debt-management guidelines that its legislature can bypass relatively easily. In contrast, states such as Idaho and Iowa

2. Tim Jenkinson, "Private Finance," *Oxford Review of Economic Policy*, vol. 19, no. 2 (2003), pp. 323–334.

are less able to borrow money because they require voters' approval to issue general-obligation debt backed by the full faith and credit of the state.

When those limits would constrain state and local governments from carrying out highway projects, alternative approaches that relied on private debt or equity might become more attractive. For example, the rules governing a state's budgetary practices may require that funds provided through the traditional approach—that is, by issuing bonds—be counted against such limits. But those rules may not require that a comparable obligation taken on by a public-private partnership be similarly counted—even though, as discussed later, taxpayers or users of the highways have similar liabilities in either case.

Measuring the Cost of Financing

A fundamental question about public-private partnerships that use private financing is whether the private approach can reduce the cost of a project's financing, and thus its total costs, when compared with traditional financing. Answering that question requires a comprehensive measure of the cost of financing, which should encompass the following:

- The cost of the risk borne by taxpayers, including the required returns on the investments of all claimants to the revenues from the project, whether they be debt holders or equity holders (the taxpayers, in the case of publicly financed projects);
- The cost of interest subsidies provided when interest rates are lower than they would otherwise be, either because the federal government provides financing at lower-than-market rates or because the interest paid on municipal debt is tax-exempt;
- The forgone revenues from depreciation allowances that allow the private partner to reduce its federal income tax liability; and
- Transaction costs, such as the cost to issue bonds, the cost of monitoring and enforcing the terms of contracts, and any legal costs associated with obtaining the financing.

Broadly speaking, the comprehensive cost of financing a highway project privately is usually about equal to the cost of financing it through the traditional public approach if the cost of providing taxpayers with a fair return on their equity investment is taken into account.

The Cost of the Risk Borne by Taxpayers

In evaluating projects that are financed in the traditional way, many analysts have assessed only the cost of the interest to be paid on bonds issued by the state or local government. But the interest rates on those bonds typically do not incorporate the cost of the risks inherent in the project that the bonds are being used to finance. The rates tend to be low because the bonds are backed by the general taxing authority of the government; investors generally do not require higher returns to compensate them for the project's risk of default because the cost of that risk is borne by taxpayers rather than the lender. (In addition, as discussed later, because the interest on many such bonds is tax-exempt, the rate of interest that bondholders receive can be lower than what they would require to lend in the private markets.)

However, the cost of financing a project that has risks associated with it can never be measured entirely by the cost of debt whose repayment is guaranteed by a government. Revenues from a project might exceed the promised payments on the project's debt, and those revenues would become available to finance other public purposes or reduce taxes. But revenues might also fall short of promised payments on the debt, in which case the government would have to raise taxes or reduce spending to make up for the shortfall. Thus, some form of explicit or implicit equity investment is necessary to absorb the difference between the cash flows that are expected and those that will be realized. For investments in highway construction that are financed by public debt, taxpayers play the role of equity holders, benefiting from greater-than-expected revenues but also absorbing the risk of shortfalls in receipts. A comprehensive measure of financing costs takes into account the cost of such equity financing, even when it is provided indirectly by taxpayers. That cost is equivalent to the return that a private investor would require to finance such a project.

Interest Subsidies

In general, the interest rate that a private lender charges, among other things, compensates for the risk that the borrower might default on the loan—the greater the perceived risk, the higher the rate charged. Whenever a government lends funds to other governmental entities or to the private sector at interest rates lower than those that would be offered on investments of similar risk in com-

petitive private markets, it is providing taxpayer-funded subsidies. For instance, the federal Transportation Infrastructure Finance and Innovation Act (TIFIA) program allows state and local governments as well as private entities to obtain financing for up to a third of a qualifying project's cost from the federal government in the form of loans or loan guarantees. Those loans are made at the interest rate paid on Treasury securities, despite the fact that such projects are considerably more likely than the Treasury to default.[3]

The federal income tax exemption for interest on municipal bonds is another way in which projects' interest costs can be subsidized. The cost of that exemption should be part of a comprehensive measure of financing costs but is not always included in such calculations. The interest rates that states and localities pay on the municipal bonds they issue understate the full cost of that method of financing. Rates on those bonds are lower than on private debt that is otherwise comparable because investors accept the tax advantage in lieu of a higher interest rate. Tax-exempt debt thus creates savings for the state or local government, but it creates costs for the federal government in the form of forgone revenues.[4]

Such subsidies distort decisions about which projects to finance and what approach to use in doing so. For riskier projects, the difference between the rate at which a governmental entity can borrow and the rate a private borrower must pay—which reflects default risk as well as the federal tax exemption—is larger. When a government lends funds to project managers at its (lower) cost of borrowing, it is accepting those greater risks, basically by providing larger subsidies on riskier loans, which creates an incentive for investments in riskier projects.

Moreover, in many cases, the different approaches to financing a project are evaluated at least in part by comparing the interest rates that a state would have to pay to borrow money with the rates that a private partner would have to pay. Subsidies conveyed through government-provided financing discourage the use of private financing because those who lend to a private partner will require a rate of return that reflects the unsubsidized cost of a project's risk. Such subsidies are particularly distorting in cases in which it would be more efficient to use private financing. For instance, private financing, with its heightened exposure to the risk of losses, might improve the incentives for a private firm to carry out a project in the most efficient way possible.

Depreciation

Another factor that may not be considered in measuring the cost of financing stems from the way the tax code treats depreciation in the value of assets. A private partner that leases a road for a long period—for example, 99 years—owns the road for tax purposes. The tax code allows that private entity to reduce its federal income tax liability by depreciating the value of the highway (the asset) over a period of years.[5] Under such an arrangement, the tax treatment of depreciation reduces federal revenues compared with what they would have been if the road had been under traditional public ownership, a loss that should also be included when comprehensively measuring the cost of financing for a highway project. The tax advantage that depreciation represents cannot be claimed by a state or local government; however, the private partner may share the tax benefit with the state or locality by offering larger payments when bidding on a project, so as to win the contract.

3. The TIFIA program provides credit assistance to finance surface transportation projects of national and regional significance. Eligible applicants include state departments of transportation, transit operators, special authorities, local governments, and private entities. TIFIA loans have parity with other "senior debt" (that is, the debt first in line for repayment) in cases of bankruptcy, insolvency, or liquidation, but they are "junior" in their claim on cash flows from projects in default. To keep the subsidy relatively low, the TIFIA program is restricted to investment-grade projects (those for which the ratings agencies have rated the senior debt obligations at or above a certain grade—BBB- from Standard & Poor's or Baa3 from Moody's). TIFIA is found at 23 U.S.C. §§ 601 et seq. (2006); 112 Stat. 241; 119 Stat. 1239, 1246–1247; 120 Stat. 1338; 122 Stat. 1577.

4. Not all of the gains accrue to the state. Bondholders in higher tax brackets can lower their tax liability by holding tax-exempt bonds. According to several studies, about 20 percent of the revenues that the federal government forgoes accrues to bondholders instead of to the state or locality that issues the bond, thereby costing the federal government more than the aid that is provided to the state or local government. See Congressional Budget Office and Joint Committee on Taxation, *Subsidizing Infrastructure Investment with Tax-Preferred Bonds* (October 2009), p. 34.

5. Most assets lose their value over time—in other words, they depreciate—and must be replaced once the end of their useful life is reached. In accounting terms, depreciation is a noncash expense that reduces the value of a company's asset as a result of wear and tear, age, or obsolescence. Because it is a noncash expense, depreciation lowers the company's reported earnings but does not diminish its cash flow.

Transaction Costs

Financial transactions such as the issuing of bonds also involve costs, which may differ depending on whether a project is publicly or privately financed. Some states, for example, enjoy administrative economies of scale because they issue large volumes of bonds on a continuing basis. (Among the most frequent issuers in 2010 was the state of California, with 76 different bond issues valued at about $38 billion in total; in those transactions, the state made use of the experienced staff and debt-issuing capabilities of the state treasurer's office.)[6] Even so, some private companies, particularly large ones, might incur lower transaction costs for financing debt than state and local governments would incur. That is because municipal bond markets are subject to less-stringent regulation and weaker disclosure requirements than are the markets for private debt. As a result, risk is less transparent, and lenders in many cases protect themselves against unforeseen losses by demanding higher interest rates than they might ordinarily require. That caution has led to periods in which governments paid a premium, compared with what private firms would pay, to issue municipal bonds.

States that choose private financing through a public-private partnership may also pay higher monitoring and legal costs than they would have paid had they chosen traditional financing, although such costs generally account for only a small portion of total expenditures on a project.[7] Contracts that establish public-private partnerships are likely to contain many more provisions than do contracts for traditionally financed projects, especially when private financing is involved. Stipulations about competing roadways and limits on the value of tolls pose some of the larger complications involved in partnership contracts and have in some cases (for example, the SR-91 Express Lanes project in California, discussed later) led to protracted legal battles that increased the costs associated with a project. A comprehensive measure of a project's financing costs should take those transaction and contract-related monitoring costs into account.

6. California State Treasurer's Office, Public Finance Division, Investor Relations, "California Transactions by Issuer: January 1, 2010, Through December 31, 2010."

7. Such costs might include fees paid to consulting firms and third parties (sometimes law firms) to measure traffic and review regional development plans to determine their effect on toll revenues. In cases in which payments are not made on time, those costs might comprise legal representation as well.

How Financing Can Affect Participants' Incentives

Although the comprehensive costs of financing a highway project with private capital or with public borrowing are largely the same, the incentives associated with private financing may encourage the partners in the project to reduce its costs and shorten its schedule. In particular, giving a private partner an equity stake in a project as well as control over the project's execution generally encourages more efficient management than the traditional approach affords. Under the traditional approach, a contractor may have only a limited incentive to control costs because cost increases in many cases can be passed on to the government. In contrast, holders of equity claims usually have more of an incentive to control a project's costs because they are the last to be paid on a project and will receive a payment only if the cash flows—from the state or local government directly or from toll revenues—are sufficient to cover costs. (Chapter 3 further examines the effects of incentives in controlling the costs and speed of completion of highway projects.)

However, equity financing is not the only way to provide incentives to contractors to manage projects efficiently. Governments can use the traditional approach in conjunction with other mechanisms to achieve the same ends. Alternatives include incentive payments or penalties that are contingent on the private contractor's meeting specific milestones regarding costs or the project's completion.

Experience with Private Financing of Highway Projects

Only a small number of highway projects in the United States have involved public-private partnerships that included private financing. Assessments of those projects indicate that such partnerships may accelerate the provision of financing—for example, by circumventing states' financing limits—but they do not generally result in additional financing. Of the projects that have been completed, most of those that were financed through tolls have failed financially because the private partners overestimated the revenues that the project would generate and were thus unable to fully repay the project's debt. Perhaps in response to that history, projects that are still under construction rely less on tolls for revenue; more commonly now, private partners are compensated through a state's general revenues, thus limiting their risk

of not being repaid. Public-private partnerships have also increasingly replaced the funds obtained through private means (at market rates) with tax-exempt bonds or bonds that provide a credit against taxes owed. That change has brought the projects more in line with the traditional approach, lowering the private partners' costs at the expense of federal taxpayers and increasing the amount of the government's implicit equity and risk. In doing so, newer projects may have diminished the incentives associated with private financing to control costs and complete the project quickly.

The history of privately financed roads in the United States encompasses 21 projects that have either been under way or completed during the past 20 years. The value of the contracts for those projects totals $16 billion, a little more than one-half of 1 percent of the approximately $3 trillion that all levels of government spent on highways over the period. (Both of those amounts are in 2010 dollars.) On the basis of data from a study done for the Federal Highway Administration, researchers have estimated that between 1996 and 2006, 50 to 75 miles per year of new urban limited-access highways were privately financed through public-private partnerships that relied on tolls to provide returns on investments.[8] That volume of construction accounted for between 30 percent and 40 percent of new capacity for such highways. In the past few years, the number of partnerships for road projects that have private financing has increased; almost 70 percent of the $16 billion in contracts has been committed since January 2008.

Some of the arrangements that are considered to be private financing are, however, fundamentally forms of public financing. For example, of the 21 privately financed public-private partnership projects, 7 are part of a design-build-finance program in Florida. Under that program, private firms finance each project entirely with private debt, which is to be repaid over a predetermined time—usually five years—with future grants from the federal government and the state and with revenues from tolls paid by users of the completed road. The guaranteed repayments through the state eliminate much of the transfer of risk that takes place with other projects that use private financing. Thus, the financing for those projects is essentially public, and the public-private partnership structure of the 7 projects is similar to that of the design-build approach.

In the remaining 14 privately financed projects, the amount of risk that was transferred to the private partner varied from project to project. In some instances, the financial risk was still borne primarily by taxpayers, who were responsible for repaying debt incurred by the private partner. In other instances, the private partner bore all of the risk of the investment—specifically, that its money might be lost if the project did not produce the revenues that were expected. Over the past 20 years, 8 of the projects, which vary in size but which all involve contracts of more than $50 million, have been completed. Six such projects are still under construction.

Completed Projects

A review of the eight completed projects offers little evidence that public-private partnerships provide additional resources for roads except in cases in which states or localities have chosen to restrict their spending by imposing legal constraints or budgetary limits on themselves (see Table 2-1). To varying degrees, all eight projects that made use of private financing took place in states in which legislatures could have issued bonds to finance the work through traditional means. In some cases, however, the use of a public-private partnership accelerated the project's access to financing by circumventing restrictions that some states have imposed on themselves and that limit their ability to issue additional debt. (Earlier financing of a road project adds value when it allows the public to enjoy the benefits of the new road sooner than would otherwise be possible.)

63-20 Corporations. Three early projects (financed between 1998 and 2002) that have been completed used a financing structure similar to the traditional public approach in that the projects used bonds issued by a semipublic agency—a so-called 63-20 corporation.[9] Under such an arrangement, a nonprofit entity—jointly

8. See Benjamin Perez and Steve Lockwood, *Current Toll Road Activity in the U.S.: A Survey and Analysis*" (prepared for the Office of Transportation Policy Studies, Federal Highway Administration, August 2006), www.fhwa.dot.gov/ipd/pdfs/toll_survey_0906.pdf; and Robert Poole, "Tolling Is the Key to Adding Highway Capacity," *Surface Transportation Innovations,* No. 31 (Los Angeles: Reason Foundation, May 1, 2006), reason.org/news/show/surface-transportation-innovat-30. Urban limited-access highways exclude rural and suburban roads, where tolls are unlikely to yield sufficient revenues, and roads that have lower traveling speeds and numerous intersections, where toll operations would be more difficult and costly.

9. The corporations were established on the basis of the Internal Revenue Service's 1963 revenue ruling 63-20 (Rev. Rul. 63-20, 1963-1 C.B. 24).

Table 2-1.

Completed Highway Projects That Used Public-Private Partnerships with Private Financing

	Dulles Greenway	SR-91 Express Lanes	Camino Colombia Bypass	Atlantic City-Brigantine Tunnel	Southern Connector	Pocahontas Parkway	Route 3 North	South Bay Expressway (S. Section)
				Description of the Project				
Date of Opening	1995	1995	2000	2001	2001	2002	2005	2007
Location	Va.	Calif.	Tex.	N.J.	S.C.	Va.	Mass.	Calif.
Sources of Revenues	Tolls	Tolls	Tolls	Tolls/Taxes	Tolls	Tolls	Taxes	Tolls
Type of Public-Private Partnership	DBFO	DBFO	DBFO	DBF	DBF	DBFO	DBF	DBFO
Length of the Road (Miles)	14	10	22	2	16	9	21	10
				Financial Structure and History				
63-20 Corporation[a]	No	No	No	No	Yes	Yes	Yes	No
Bankruptcy Declared	No	No	Yes	No	Yes	No	No	Yes
Public Buyout of Private Partners	No	Yes	No	No	No	No	No	No
				Sources of Financing (Millions of 2010 dollars)				
Private								
Debt	439	153	91	147	247	655	481	400
Equity	56	31	18	0	0	0	0	209
Public								
TIFIA program	0	0	0	0	0	0	0	165
Other[b]	0	0	0	285	0	0	0	0
Total Project Cost	**495**	**184**	**109**	**432**	**247**	**655**	**481**	**774**

Source: Congressional Budget Office.

Note: DBF = design-build-finance; DBFO = design-build-finance-operate; TIFIA = Transportation Infrastructure Finance and Innovation Act.

a. A 63-20 corporation is a nonprofit entity that is allowed to issue tax-exempt bonds to finance tangible public assets.

b. The Atlantic City-Brigantine project relied on a casino's future contribution to the Casino Reinvestment Development Authority as well as on funds from the South Jersey Transportation Authority and the New Jersey Transportation Trust Fund Authority.

managed by the public and private sectors—is set up to issue tax-exempt bonds (63-20 corporations have no equity) to "finance tangible public assets." Projects financed through 63-20 corporations must repay the corporation's bondholders from a stream of revenues (either tolls or other state funds) in the same manner that states must repay bondholders who purchase municipal debt. Given the governmental involvement in the formation and management of 63-20 corporations and the ways in which they are used, it is questionable whether their borrowing should necessarily be considered "private financing," especially in cases in which states are ultimately responsible for servicing the debt.

The 63-20 mechanism was initially of interest to some state legislators because the bonds' tax exemption (like that for municipal bonds) allowed bondholders to take advantage of a federal subsidy and because in many states such debt was not constrained by regulations or limits on borrowing. The Southern Connector in South Carolina, the Pocahontas Parkway in Virginia, and Route 3 North in Massachusetts were all financed through 63-20 corporations. The source of repayment for the bonds for the first two projects was revenue from tolls; the source for the third was annually appropriated state funds.

However, since those projects were undertaken, the 63-20 corporate structure has not been used, for several reasons. Because the corporations do not have an equity stake in any project, bondholders retained the risk associated with the project but had no ability to control the project's outcome. Conversely, the private firms that managed the projects had only weak incentives to perform the work efficiently because they were not exposed to the risk of

shortfalls in revenue (only the bondholders faced that risk). Bondholders on the Southern Connector project, for example, have borne the full risk that revenue from tolls might not meet expectations. Thus, when toll collections were less than anticipated, the state of South Carolina provided no assistance to supplement the revenues that went to the 63-20 corporation, and the bondholders bore the cost of the revenue shortfall. In contrast, the bondholders on the Route 3 North project have borne no such risk because the project's financing structure makes it similar to that used in the traditional approach: The repayment of bondholders is contractually set and annually apportioned by the Massachusetts legislature from the state's general fund. (In that case, the 63-20 corporation effectively circumvents the state's limits on debt.) Another reason for the recent lack of use of the 63-20 structure is that, as special entities, the corporations incur additional costs for issuing and managing debt, compared with costs under the traditional approach to financing.

Projects Financed with Private Equity. Of the remaining five completed projects with private financing, four made use of private equity financing, transferring the risks related to their schedules and costs to the private sector. The three earliest projects—the Dulles Greenway, the SR-91 Express Lanes project in California, and the Camino Colombia Bypass in Texas—transferred the most risk by using a mix of private debt and equity rather than public funds. Financing for the South Bay Expressway, in San Diego, comprised mainly private equity and debt but also took advantage of the federal subsidy inherent in using funds from the TIFIA program. (The Atlantic City-Brigantine Tunnel project in New Jersey transferred even less risk to the private partner because its financing approach included no private equity; instead, the project was financed partly through private debt and partly through taxes.)[10]

The four projects that involved private equity have not been successful in managing the risks of private financing, especially when returns to investors were based on toll revenues. The SR-91 Express Lanes project has been the most financially successful but only after an extensive legal fight that centered on the public partner's desire to add lanes without tolls (which would have affected the private partner's revenues from the lanes with tolls). The road was built in 1995 for about $135 million ($183 million in 2010 dollars); the controversy over the additional lanes subsequently led to the road's being sold to the Orange County Transportation Authority, a public agency, in 2003 for $208 million ($244 million in 2010 dollars).[11] The other projects—the Dulles Greenway, the Camino Colombia Bypass, and the South Bay Expressway—also relied exclusively on tolls to repay their financing, and they have all experienced traffic and revenues that were less than projected by as much as 50 percent, leading to bankruptcy for the South Bay Expressway and the Camino Colombia Toll Road and periods of losses for the Dulles Greenway. The South Bay Expressway, which had received some financing from the federal TIFIA program, illustrates what can happen to taxpayers as the ultimate equity holders. The project filed for Chapter 11 bankruptcy in March 2010, finally emerging in May 2011. The new financing and ownership structure required by the bankruptcy court imposed a loss of 42 percent on federal taxpayers, replacing the original TIFIA investment with a package of debt and equity worth only 58 percent of the original investment.[12]

With the exception of the SR-91 Express Lanes, private equity investors' expectations of profitability for the projects have been unfulfilled. That outcome may partially explain why, since 2002, no major highway projects in the United States have been financed exclusively through private sources.

Ongoing Projects

New public-private partnerships have sought to reduce their borrowing costs by relying on publicly subsidized borrowing through the TIFIA program and through private activity bonds (PABs) issued by local municipalities

10. The Atlantic City-Brigantine Connector project relied on a casino's future contribution to the Casino Reinvestment Development Authority as well as funds from the South Jersey Transportation Authority and the New Jersey Transportation Trust Fund Authority.

11. Robert W. Poole Jr., *Orange County's 91 Express Lanes: A Transportation and Financial Success, Despite Political Problems*, Policy Brief 39 (Los Angeles: Reason Foundation, no date).

12. Randall Jensen, "Tollway Exits Chapter 11: TIFIA Ends Up Taking a Haircut," *Bond Buyer* (May 6, 2011).

Table 2-2.

Ongoing Highway Projects That Use Public-Private Partnerships with Private Financing

	I-495 HOT Lanes	I-595 Managed Lanes	SH-130 (Segments 5 and 6)	North Tarrant Express	Port of Miami Tunnel	I-635 LBJ Freeway
			Description of the Project			
Start of Construction	2008	2009	2009	2010	2010	2011
Expected Completion Date	2013	2014	2012	2015	2014	2015
Location	Va.	Fla.	Tex.	Tex.	Fla.	Tex.
Sources of Revenues	Tolls	Tolls/Taxes	Tolls	Tolls	Taxes	Tolls
Type of Public-Private Partnership	DBFO	DBFO	DBFO	DBFOM	DBFO	DBFO
Length of the Road (Miles)	14	11	40	13	1	13
			Sources of Financing (Millions of 2010 dollars)			
Private Financing						
Debt	0	787	700	0	344	0
Equity	357	219	216	429	81	677
Public Financing						
TIFIA program	601	608	439	655	344	857
Private activity bonds[a]	601	0	0	401	0	611
Other[b]	417	234	0	578	312	494
Total Project Cost	**1,976**	**1,848**	**1,355**	**2,064**	**1,081**	**2,639**

Source: Congressional Budget Office.

Note: HOT = high occupancy/toll; DBFO = design-build-finance-operate; DBFOM = design-build-finance-operate-maintain; TIFIA = Transportation Infrastructure Finance and Innovation Act.

a. A private activity bond is a bond issued by or on behalf of a local or state government to finance the project of a private business.

b. Mostly loans or grants from states or localities.

(see Table 2-2).[13] All of the six ongoing projects have made use of federal subsidies through TIFIA. That choice of financing constitutes a return to some features of the traditional approach in which the public sector retains greater risks, especially the risk of default, as in the South Bay Expressway bankruptcy. Ongoing projects have secured nearly a third of their financing from the TIFIA program, just short of the maximum share that the program allows. In addition, all but one of the projects have secured loans or grants from states or localities as part of their financing.

Three of the six ongoing projects have covered some of their financing needs by using PABs, whose tax advantages lower the private partner's debt-service payments. In the other three cases, though, project managers responsible for a project's financing have had to take out bank loans. That source of private capital had become more attractive than usual for project managers because during the recent economic downturn, the yields for bonds in municipal bond markets, including those of PABs, greatly increased relative to those on alternative investments, making it more costly to finance projects by using bonds. At the peak of the financial market's troubles in late 2008, the interest rate offered on municipal bonds had increased by nearly 4 percentage points relative to the TIFIA program's financing, which is perceived to be a safer alternative. That rise in rates reflected people's concerns about the ability of state and local governments to pay off the bonds they were issuing.

13. A private activity bond is a bond issued by or on behalf of a local or state government to finance the project of a private business. By giving some PABs tax-preferred status—generally by making the bonds' interest tax-exempt—the federal government provides a form of credit assistance.

Holders of private equity remain the residual claimants on those ongoing projects, but the equity contributions are probably too small to insulate bondholders from the risk of default—and its accompanying losses—should the project fail. Unlike completed projects, for which private financing was a primary avenue of securing funds, projects currently under construction appear to use less private financing and to limit the use of private equity to a relatively small portion of the project's total financing, probably as an incentive for controlling costs and completing the project on time. For example, in the Port of Miami Tunnel project, the equity component has shrunk to as little as 8 percent. The project is mainly financed by availability payments, in which the state takes on the risk that use of the road and tolls will be insufficient to repay investors and provides the private partner with a series of lump-sum payments from the state that have been determined in advance. For other ongoing projects, the equity component generally has remained at between 15 percent and 25 percent of a project's financing.

Another recent project in Florida, the I-595 Managed Lanes project, has moved to the use of availability payments to repay debt, which reduces the risk borne by the private sector (particularly the risk of insufficient road use). That project has instead employed contractual clauses, such as performance bonuses and penalties, to provide incentives to the private firm to manage the project in the most efficient way possible.

CHAPTER

3

Private Provision of Highways

Under the traditional approach to highway projects—in which a state or local government completes a design for a project and then, after a bidding process, contracts with a private company to build the road—the government retains control over all elements of the project and bears the risks (for example, of cost overruns) that necessarily come with such an arrangement. That greater degree of control under the traditional approach allows the government to be flexible in responding to changing circumstances, such as greater-than-anticipated demand, that may affect costs of the project that are not generally considered by the private sector (including the costs to third parties, such as users of the road, who would face delays if the road was built with insufficient capacity). But the government's control also increases the potential for inefficiency—for example, in the form of problems in transferring information, say, from the designer to the builder.

In contrast, a public-private partnership can reduce the risk borne by the government on a project by shifting a substantial portion of that risk from the government to the private entity. Through contracts that bundle two or more elements of the work, the project may be completed more quickly or more cheaply if the greater control afforded the private partner through such arrangements gives it stronger incentives than the traditional approach offers to constrain costs and meet established schedules. But partnership contracts that achieve those goals can be challenging to formulate, especially in light of the lengthy period over which many of the contracts extend.

A few studies have looked at the use of public-private partnerships as an approach to designing, building, operating, and maintaining highways. The research has found that, compared with the traditional approach, public-private partnerships have slightly reduced the time required to complete the design and construction phases of road projects and lowered construction costs by a small amount, on average. However, little attention has been devoted to the use of partnerships (versus the use of traditional contracting by the public sector) to operate and maintain highways. The Congressional Budget Office examined two highways with comparable, albeit limited, data on operations and maintenance provided at different times by public and private partners and found some reductions in costs under the private entities' management.

Managing Risks Through Contracts

A primary difference between using a public-private partnership to carry out a highway project and using the traditional approach is the nature of the contracts that establish the relationship between state or local governments and the private sector. Those contracts lay out the responsibilities of the parties as well as budgetary, legal, or other constraints and any required payments. They also implicitly or at times explicitly allocate the risks associated with a project that might lead to cost overruns and assign control for activities that might mitigate those and other types of risk. Under the traditional approach, with different firms providing each element of a highway project (design, construction, operations, and maintenance), the contracts that set out those responsibilities give contractors only limited incentives to consider the effects of their actions on the providers of the other elements. By comparison, the bundling of elements that characterizes public-private partnerships leads to contracts that reallocate the project's risk and control and try to better align the contractors' incentives with the government's goals of lowering costs and completing the road quickly.

If a public-private partnership contract is to properly balance risk and control for the various parties, information is required about the risks that the private firm faces and its ability to mitigate them. That information, however, may be known only to the firm because it may be

proprietary; alternatively, it may be unknown in advance to any of the parties. Properly allocating control over the tasks necessary to complete a project is tied to the allocation of risk; more specifically, a private firm is generally willing to accept additional risk only if it can limit that risk and is granted sufficient control to do so. But such transfers of control may raise concerns about a state or local government's ability to protect the public's interests. Thus, in creating a contract that effectively aligns private incentives with the project's public goals, the public and private partners face two primary areas of concern: issues related to information and incentives and issues related to control.

Information and Incentives

A common problem with the traditional method of providing highways is that it does a relatively poor job of addressing the risks that arise from privately held or incomplete information. Information known to one participant but not another may mean that a project will pass up the use of production options and methods that can reduce costs or ensure that schedules are met. An example is a case in which a contractor is selected before the design is completed. If the contractor did not share information about its construction capabilities—say, its ability to use large prefabricated building components—the designer of a highway might forgo a lower-cost design that made use of such components. Conversely, if contractors competing for a job were not informed about all of the specific details of a design beforehand, they would have an incentive to build in extra charges as a cushion against the cost of unforeseen design features.

Discovering such relevant information about a project carried out through the traditional approach can be difficult because the project's participants may strategically withhold information to gain an advantage in their contract negotiations. A private firm that revealed its production capabilities and approaches might be at a competitive disadvantage in relation to other firms in its industry and find itself in a weakened bargaining position in relation to the government. With such information, the government could determine the private firm's costs for completing a project and then use that information to pay the lowest amount at which the private firm would still accept the job. That advantage for the government would limit the private firm's potential profits on the initial contract and on any additional long-term arrangement it might agree to.

One way to address the problem of privately held information is to consolidate design, construction, operations, and maintenance under the control of one project manager. In that case, nothing would be gained by strategically withholding or misrepresenting information because all the potential benefits from the project would accrue to one party. Consolidating multiple tasks would also help in the coordination of a project whenever full and reliable information was necessary for a smooth transition from one task to another (such as the transition from the design to the construction stage). The managing party could be held responsible for any problems that arose during a transition and then work to eliminate them.

The drawbacks of a lack of consolidation and coordination are laid out in a study by the National Cooperative Highway Research Program published in 2006. Researchers suggest that using two separate contracts (one for design and the other for construction of a road) imposes "constructability risk" on the project's owner (the public-sector partner).[1] In other words, the owner shoulders the risk that the design produced for the builders is not the most efficient option or may not match the builder's abilities. If such a mismatch occurs, the owner of the project must first pay the builder to fix the resulting problem and then attempt to collect any added costs from the designer—which may be difficult because the owner must first prove that the designer has legal liability stemming from a design that became more difficult and costly to complete than had been expected.

A contract that consolidates responsibility for a project's design, construction, operations, and maintenance in the hands of one contractor may also better align that contractor's incentives with the project's goals over the long term. Separate contracts for construction and maintenance may encourage the private builder to con-

1. See Sidney Scott III and others, *Best-Value Procurement Methods for Highway Construction Projects*, National Cooperative Highway Research Program Report 561 (Washington, D.C.: Transportation Research Board of the National Academies, National Cooperative Highway Research Program, 2006). The National Cooperative Highway Research Program, created in 1962, conducts research in acute problem areas that affect highway planning, design, construction, operation, and maintenance nationwide. It is administered by the Transportation Research Board and sponsored by the members (state departments of transportation) of the American Association of State Highway and Transportation Officials, in cooperation with the Federal Highway Administration.

struct the road at the lowest possible cost but offer no incentive to consider and potentially improve the highway's long-term performance (for example, by initially using more expensive but longer-lasting materials). A more transparent exchange of information about the project—specifically, the disclosure of expected long- and short-term project costs—between the private firm and the public partner might reduce the cost of operating and maintaining the road in the future. One study found that for every dollar spent on preventive maintenance, between $4 and $10 was saved (depending on how soon the maintenance was undertaken) when the road eventually had to be rehabilitated.[2] Thus, assigning the risk of higher long-term costs for maintenance to the builder through a public-private partnership contract would provide the incentive to use whatever materials or methods would minimize such costs over the entire life of the highway and not just during the construction phase. Indeed, using a public-private partnership to complete a highway project may be most cost-effective in instances in which potentially large savings can be gained by managing the risk of higher-than-expected costs over the life of the road.

Control

Transferring control of a highway project to the private sector, which occurs under public-private partnership contracts that assign responsibility for more than one element of a project to a single private entity, places a premium on reducing costs and meeting schedules, which in some cases may come at the expense of the government's other goals. A prominent issue in ceding control of a project to the private sector is determining which partner should have the authority to set tolls. Transferring that authority to the private partner, which in many cases depends on toll revenues for a return on its investment, could result in higher toll rates that might have a disproportionately negative effect on some motorists—for example, low-income drivers, for whom any given toll represents a larger percentage of income than it does for a higher-income driver.[3] Even so, low-income motorists could gain from the more reliable travel times that higher tolls might induce when the value of motorists' time was greatest—for example, when an individual was running late on the way to work or to pick up children.[4]

The experience of the Chicago Skyway, a highway that shifted from public to private control, suggests what may happen when toll setting is under the control of the private entity. During a period of public management, not only did tolls on the Chicago Skyway change infrequently but they actually decreased by about 25 percent in real (inflation-adjusted) terms between 1989 and 2004.[5] In contrast, under private control of the roads, tolls have risen by nearly 60 percent in real terms since 2005. Additional increases are scheduled to occur in the future as part of the agreement to transfer all authority for tolls to the private sector.[6] The higher tolls may have encouraged more efficient use of the roads, lowered the cost of operations and maintenance (by reducing the volume of traffic), and boosted revenues. Nevertheless, the transfer of control may have made some motorists worse off.

Transfers of control via a public-private partnership can end up costing the government more than it anticipates. For example, when conflicts over control lead to renegotiation of provisions of the public-private partnership contract, the government generally ends up bearing greater costs than those it had assumed under the original contract.[7]

2. Gilbert Y. Baladi and others, "Cost-Effective Preventive Maintenance: Case Studies," *Transportation Research Record: Journal of the Transportation Research Board,* vol. 1795 (2002), pp. 17–26.

3. Government Accountability Office, *Highway Public-Private Partnerships: More Rigorous Up-Front Analysis Could Better Secure Potential Benefits and Protect the Public Interest,* GAO-08-44 (February 2008).

4. For a discussion of that issue, see Congressional Budget Office, *Using Pricing to Reduce Traffic Congestion* (March 2009), pp. 12–13.

5. Government Accountability Office, *Highway Public-Private Partnerships*.

6. The public-private partnership contracts for the Skyway and for the Indiana Toll Road, which also shifted from public to private control during approximately the same period, built in a minimum increase of 2 percent but tied additional annual increases in tolls to the consumer price index or the nominal rate of growth of gross domestic product, whichever is greater. See Government Accountability Office, *Highway Public-Private Partnerships*, p. 31.

7. According to a study of eight project renegotiations in the United States, as of early 2011, six had been settled in favor of the private partner, and two were unsettled. See Eduardo Engel, Ronald Fischer, and Alexander Galetovic, *Public-Private Partnerships to Revamp U.S. Infrastructure* (Washington, D.C.: Brookings Institution, The Hamilton Project, February 2011), p. 11, www.hamiltonproject.org/papers/public-private_partnerships_to_revamp_u.s._infrastructure.

Another issue in transferring greater control of a project to a private partner is that the public partner may reduce its ability to achieve other public goals. The SR-91 Express Lanes project in Orange County, California, illustrates how a project's profitability may conflict with the public's interests. The contract for the project included "non-compete" provisions that did not allow competition from additional lanes without tolls (which would have reduced the value of the private partners' toll lanes). But concerns about congestion and drivers' safety led to a proposal by the California Department of Transportation to expand the number of lanes on the road that did not have tolls. After turning to the courts, the parties settled the dispute by having the Orange County Transportation Authority buy out the private partner.

Some analysts have suggested that the terms of public-private partnership contracts could be designed to reduce the likelihood of renegotiations. One suggestion is for the use of present value of revenue (PVR) contracts.[8] Under a PVR contract, the government sets the discount rate and the schedule of user fees (tolls), and the potential private partners then submit bids for the present value of user fees that they are willing to accept in order to enter into the arrangement. The lowest bid wins, and that amount becomes part of the contract.[9] Such an arrangement limits renegotiations because the structure of the contract makes it difficult to increase the transfer of funds from the public to the private partner. The length of the agreement, for example, cannot be extended because it is by definition variable—the contract ends when the private firm has received the amount it had bid. Increasing user fees simply shortens the length of the contract without increasing its value. If the public-private partnership is profitable in the long run, PVR contracts can reduce the incentives of both partners to renegotiate their original agreement, thus constraining their legal and monitoring expenses for the project.

8. The present 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 present value depends on the rate of interest—known as the discount rate—that is used to translate future cash flows into current dollars. (For example, if an investment that will yield $100 one year in the future is discounted at 5 percent, its value today is $95.)

9. For more information on PVR contracts, see Engel, Fischer, and Galetovic, *Public-Private Partnerships to Revamp U.S. Infrastructure*, p. 18.

Experience with Public-Private Partnerships for Highway Projects

Because public-private partnerships have played a small role in providing U.S. highway infrastructure over the past 20 years, only limited data are available about their effectiveness in reducing costs and providing roads more quickly by comparison with the traditional approach. Federal agencies collect little information about whether highway projects are completed on-budget and on time, and states vary in the kinds of data they collect. The discussion that follows relies on the best available evidence: data from the limited number of ongoing projects; evaluations by private-sector analysts and by federal, state, and local transportation officials who work closely with the projects; assessments by other experts; and published studies that have analyzed public-private partnerships. However—owing to the small number of projects in the studies' samples and the difficulty in modeling what would have happened if a public-private partnership had not been used—this analysis cannot present definitive conclusions about the effectiveness of implementing the approach on a wide scale.

Providing highways through such partnerships is generally done in two stages, which can be combined in a joint contract but may also be carried out separately by either the public or the private partner: the initial design and construction (design-build) stage and the subsequent longer-term operations and maintenance stage.

Design-Build Stage

The design-build method—involving a fixed-price contract between one private entity and a public agency to jointly manage the design and construction of a new road—is the most common framework for the various forms of public-private partnerships. According to the limited data that are available, use of the design-build approach appears to slightly lower the cost of highway projects, relative to use of the traditional approach, and allow their quicker completion.

One of the larger studies on the design-build method was carried out for the Federal Highway Administration and used data from 62 design-build projects completed between 1990 and 2002. Managers supplied estimates of costs for 48 of the projects (the estimates do not appear to factor in the transfer of risk to the private sector); they also provided information about the timing of all of the projects' completion. On the basis of those data, research-

ers found that, on average, this type of public-private partnership reduced costs by 2.6 percent relative to managers' assessments of what costs would have been under the traditional approach.[10] For several reasons, however, a sizable amount of uncertainty surrounds that estimate: It depends on managers' judgments; the sample on which it is based is small; and it includes findings that indicate a wide range of outcomes (one project was judged to be 65 percent more expensive than if it had been provided through the traditional approach, whereas another was judged to be 62 percent less expensive). Researchers determined that of the 48 projects, 20 cost less than they would have if they had been provided through the traditional approach, 11 cost more, and 17 were completed for about the same cost as under the traditional method.

The study's authors also concluded that the design-build approach reduced the time required to complete a project by 14 percent, on average, compared with the project managers' estimates of how long the projects would have taken using the traditional approach. Of the 62 projects whose managers provided information about schedules, 45 were completed more quickly than if they had been provided through the traditional method, 10 were completed in about the same amount of time, and 7 took longer.

Another study, by Arizona's Department of Transportation, found that public-private partnerships in the form of design-build projects had better on-time and marginally better on-budget performance compared with similar projects that used the traditional approach. The study examined 16 projects in Arizona, ranging in cost from $12 million to $184 million, that were undertaken between 1999 and 2004. Compared with outcomes under the traditional method, researchers found an average reduction of 22 percent in the duration of the contract and an average cost savings of 4 percent.[11] Those estimated savings stemmed from fewer cost overruns under the design-build method and reductions in the public agency's costs for managing and inspecting the project as well as from lower costs to the road's users, in the form of delays and congestion (to which researchers assigned dollar values).

The authors took care to compare similar projects provided through the different methods, but the small sample made a statistically rigorous analysis impossible. In reporting their findings, the authors cautioned that not all design-build or traditional projects follow exactly the same procedures, pointing out that the details of how and when certain steps in the project take place—such as when the project managers receive feedback from the construction team—may vary even within the same type of approach. If, for example, the construction team for a bridge project is brought in during the early stages of design, it can suggest large-scale changes that affect the type of bridge to be built or the choice of materials, among other considerations. But if builders are brought in when the design is nearly completed, the range of changes they might suggest is necessarily more limited. Both projects would be considered "design-build" in structure, but the details of how that framework was implemented would affect the project's success in controlling or reducing costs and completing the work on time. Those details can be a significant source of uncertainty in attempts to apply the results of one analysis to a broader group of projects.

The savings in costs from the design-build method relative to costs under the traditional approach appear to be concentrated among larger, more complex projects, for which the problems posed by privately held or incomplete information are likely to be greater. A study by two large engineering firms looked at 152 highway projects carried out in California between 1981 and 2006.[12] Researchers found that costs for 26 projects that were valued at over $100 million and used the traditional approach exceeded the initial cost estimates by an average of 25 percent. Costs for the 126 smaller, less complex projects that used the traditional approach came in, on average, below their initial projections. The FHWA study of public-private partnerships discussed above found that, according to the project managers, the design-build

10. SAIC, AECOM Consult Inc., and University of Colorado at Boulder, *Design-Build Effectiveness Study—As Required by TEA-21 Section 1307(f): Final Report* (prepared for the Department of Transportation, Federal Highway Administration, January 2006).

11. Jim Ernzen, Ron Williams, and Debra Brisk, "Design-Build vs. Design-Bid-Build: Comparing Cost and Schedule" (paper presented at the annual meeting of the Transportation Research Board of the National Academies, Washington, D.C., January 15, 2004).

12. ARUP/Parsons Brinckerhoff, *Analysis of Delivery Options for the Presidio Parkway Project* (prepared for the California Department of Transportation and the San Francisco County Transportation Authority, February 2010), p. 29, www.presidioparkway.org/project_docs/files/presidio_prkwy_prjct_bsnss_case.pdf.

method produced better results for larger (more than $100 million in value), more complex projects than for smaller, less complex projects. Such results suggest that the incentives in a public-private partnership contract do more to help control costs as the size of a project increases, compared with outcomes under the traditional method.

One reason cited for the better results from the design-build approach was a reduction in the number of "change orders" that amended or added to the original scope of a project. In many projects that used the traditional approach, change orders stemmed from missing or incomplete information about a project's design and were a significant source of cost overruns. Researchers for the FHWA study indicated that the move to the design-build approach reduced the average number of change orders on a project from 22 to 16.[13] They attributed approximately 5 percent of the cost of a design-build project to change orders. Similarly, a 2009 review of in-state projects by the Utah Department of Transportation found that among projects that used the design-build method, change orders accounted for 6.5 percent of costs, versus 14 percent of costs in projects that used the traditional approach. The Utah study concluded that, on average, the projects conducted using the traditional approach had overruns of approximately 11 percent in their total project costs—overruns that were generally borne by the state—whereas projects carried out using the design-build method had no cost overruns charged to the state.[14]

Whether those outcomes would be replicated among all highway projects, however, is unclear. If the group of completed public-private partnership projects differed in significant ways—larger volumes of traffic, for example—from other potential projects, the above outcomes would probably not be repeated. Moreover, the projects already provided through public-private partnerships may have been selected on the basis of unique but unobserved characteristics that made those projects well-suited to the use of that method. If future projects did not share similar characteristics, public-private partnerships could not be expected to yield the same results that previous studies have reported.

Operations and Maintenance Stage

Studies of the operations and maintenance portion of highway projects have been scarce, with little analytical research devoted to the potential differences in efficiency between the traditional approach and public-private partnerships. A number of problems complicate such research:

- An operations and maintenance schedule is flexible, so charges for operations and maintenance can be deferred or accelerated during a project's lifetime. For example, repairs to pavement may occur yearly—or every two, three, or more years—yet still keep the road in a state of good repair. To adequately compare operations and maintenance under the design-build and traditional approaches would require information about the entire schedule (that is, over the life of the road). Partial data could be misleading if significant repairs took place before or after the period for which data were available.

- The costs arising from operations and maintenance are determined by various factors, such as use of the road (especially by heavy trucks, which cause most of the damage to highway pavement), terrain, population density, and weather.[15] If studies of the same highway under different management regimes lacked detailed data on traffic and other factors over a long period, they could produce misleading results.

- The difficulty of assessing differences in the quality of the operations and maintenance activities provided under traditional and public-private partnership approaches may also lead to inaccurate or incomplete findings.

Two highway projects in the United States have a history of both public and private ownership that is long enough and offers sufficient data to compare costs for operations and maintenance. In 2005, the Chicago Skyway, built in 1958, switched to a public-private partnership arrangement in which the private partner provides operations and maintenance; the Indiana Toll Road, built in 1956,

13. SAIC, AECOM Consult Inc., and University of Colorado at Boulder, *Design-Build Effectiveness Study.*

14. Utah Department of Transportation, "Change Order Cost Percentages per Project and Cost Overruns per Project" (draft, Utah Department of Transportation, June 24, 2009).

15. For a discussion of the costs of pavement damage by type of vehicle, see Congressional Budget Office, *Alternative Approaches to Funding Highways* (March 2011).

switched to such an arrangement in 2006. Available data on the projects cover 10 years and 9 years, respectively. Comparing costs for operations and maintenance in the periods before and after the transfer of ownership, CBO found that by comparison with public management, private managers were able to reduce average annual expenditures by about 10 percent on both the Skyway and the Indiana Toll Road. (Expenditures were measured as the average cost per lane mile before and after the transfer.) Moreover, another study that assessed only the costs for operations on the Skyway found a decrease of 11 percent in those costs under private management.[16] (See Appendix B for details of CBO's analysis of the two projects.)

16. Engel, Fischer, and Galetovic, *Public-Private Partnerships to Revamp U.S. Infrastructure*.

Much of the reduction in costs for the projects since the transition to a public-private partnership structure appears to have come from lower labor costs: The private managers eliminated or reassigned many workers and replaced them with new employees who earned between 25 percent and 40 percent less. Although the histories of both projects seem to indicate that private control may reduce some costs of operations and maintenance, more data are needed to support that result. Other factors, such as a reduction in the volume of commercial traffic and a different frequency of maintenance work, may have contributed to the findings. The Chicago Skyway and Indiana Toll Road have experienced reductions in overall traffic of 13 percent and 21 percent, respectively, since their transition to private control. Those drops probably reflect weak economic conditions and the increase in toll rates that occurred under private control.

APPENDIX

A

Public-Private Partnerships in Other Countries

International experience with public-private partnerships may offer some lessons regarding such arrangements in the United States. However, the approach that allows for more efficient delivery of a project—that is, faster delivery at a lower cost—has varied, depending on the national environment and the characteristics of the project.

In the late 1980s and early 1990s, governments in Australia and the United Kingdom began to use public-private partnerships to systematically provide private financing for road and railway projects. The programs were known as private-finance initiatives. Once they were well established, they became the prototypes for subsequent initiatives for the construction of schools, public housing, and prisons and for water and waste management projects. The approach has become fairly common: In 2009, for example, local and regional governments as well as other public entities in the United Kingdom entered into 52 public-private partnership contracts for projects worth about $8 billion.[1]

Partnerships in the United Kingdom and Australia have generally been successful in not exceeding their projected costs. The National Audit Office (NAO) in the United Kingdom studied 37 privately financed public-private partnerships for different types of projects and found that none exceeded the costs budgeted for the original scope of work. However, for 22 percent of those projects, costs were higher than anticipated because the public agency requested additional work that was not in the original specification. In contrast, an earlier NAO study found that 73 percent of projects provided through the traditional public approach (which is similar to that in the United States in its design-bid-build framework) had cost overruns.[2] In addition, an Australian study of 67 projects, which included 23 highway projects, found that public-private partnerships exceeded their projected costs by 4 percent, on average, whereas traditional projects exceeded them by an average of 18 percent, once the contractual commitment was in place.[3]

The frequent use of such partnerships in those two countries has spurred the establishment of regulatory agencies and legislative precedents that have helped guide additional projects. In Australia, the national government set up Infrastructure Australia, an agency whose mission is to identify priorities for infrastructure projects, help secure private investment, and improve guidelines for the partnerships.[4] In the United Kingdom, the Treasury established a public-private partnership policy team inside Infrastructure UK, the national advisory entity on infrastructure. (That entity provides guidance on major projects and programs.) In addition, the private sector and

1. Dealogic, "Dealogic Project Finance Review" (press release, January 11, 2010), www.legalmediagroup.com/iflr1000/gifs/doc/DealogicGlobalProjectFinanceRev-2009.pdf. According to data from the U.K. National Audit Office, infrastructure spending in the United Kingdom is about $46 billion per year. However, that total is not directly comparable with the value of contracts for public-private partnerships because such arrangements include multiyear or even multidecade projects. For more information, see National Audit Office, *Financing PFI Projects in the Credit Crisis and the Treasury's Response*, HC 287, Session 2010–2011 (London: National Audit Office, July 27, 2010).

2. National Audit Office, *PFI: Construction Performance*, HC 371 (London: National Audit Office, February 5, 2003), www.nao.org.uk/publications/0203/pfi_construction_performance.aspx.

3. Colin Duffield, *National PPP Forum—Benchmarking Study, Phase II: Report on the Performance of PPP Projects in Australia When Compared with a Representative Sample of Traditionally Procured Infrastructure Projects* (University of Melbourne, December 2008), www.infrastructureaustralia.gov.au/publications/files/National_PPP_Forum_Benchmarking_Study_Ph2_dec08.pdf.

4. Infrastructure Australia, "Infrastructure Australia Functions as Set Out in the Infrastructure Australia Act 2008" (April 2011), www.infrastructureaustralia.gov.au/about/functions.aspx.

the government jointly provided resources to create Partnerships UK, a nonprofit organization meant to supplement the public sector's efforts.

International experience with public-private partnerships extends beyond Australia and the United Kingdom. Between 1985 and 2010, about 1,500 major public-private partnership projects (excluding those in the United States) valued at nearly $653 billion were funded worldwide. Of that total, 580 were road projects valued at over $327 billion. Projects in Europe accounted for about half that amount—$177 billion; projects in Mexico, Latin America, and the Caribbean accounted for a little more than $68 billion; and projects in Asia and Australia accounted for $64 billion. Most of the rest were in Canada ($13 billion).[5]

A study that looked at public-private partnerships in a variety of countries found that those nations had varying degrees of success in establishing an entity to identify and prioritize projects that could benefit from the use of a public-private partnership approach.[6] The keys to successful functioning of such an entity, according to that study, were that it possessed strong support from the government and had the ability to keep the public and private partners committed to working to fulfill the duties they had agreed upon as parties to the partnership contracts.

5. "International Major Projects Survey," *Public Works Financing*, vol. 253 (October 2010), p. 2.

6. Apurva Sanghi, Alex Sundakov, and Denzel Hankinson, *Designing and Using Public Private Partnership Units in Infrastructure: Lessons from Case Studies Around the World*, Gridlines Note No. 27 (Washington: Public Private Infrastructure Advisory Facility, September 2007), www.ppiaf.org/ppiaf/sites/ppiaf.org/files/publication/Gridlines-27-PPP%20Units%20in%20Infra%20-%20ASanghi%20A%20Sundakov%20DHenkinson.pdf.

APPENDIX

B

Two Case Studies of Long-Term Lease Agreements for Highway Operations and Maintenance

Long-term lease arrangements are a type of public-private partnership that can provide operations and maintenance for previously completed highways through a private partner. Under such agreements, a private firm gives a state or local government an up-front payment in exchange for compensation in the form of a future stream of revenues from tolls. The private partner then assumes control of the project—that is, the public road—and takes on the responsibility for and the costs of operating and maintaining it. At the end of the lease period (sometimes as long as 99 years), the private partner returns control of the road to the government in accordance with the terms of the lease. Because the highway project has already been completed, the private partner has had no effect on decisions about the design of the road or its original construction, both of which may affect costs for operations and maintenance over the longer term. The private partner, however, having been granted responsibility for operations and maintenance and control over the project, has the incentive to reduce those costs going forward.

Expenditures for a highway's operations and maintenance may differ under public versus private control. Those differences have two primary explanations.

- Public project managers may choose an approach to and schedules for maintaining the highway that differ from those a private project manager would employ, which will affect costs. For example, in many cases, smaller, more regular repairs are a more cost-effective approach to road maintenance than are larger, irregular repairs, but they may be less common when a road is under public control because of states' and localities' budgeting practices. Some of those governments primarily allocate the limited funds they have available for operations and maintenance to major reconstructions at the expense of small annual repairs.

- Public project managers might choose a different approach to setting and collecting tolls than a private manager would, which will affect how many drivers use the road and when they do so. For example, if the private entity increased tolls, drivers would be encouraged to use alternative roads. That would reduce traffic on the toll road (thus lowering the cost of operations) and also lessen wear and tear (lowering the cost of maintenance)—but some of those lower costs would come at the government's expense because they would be shifted to other roads.

Analyses of the potential differences in the cost of operations and maintenance when a road is under public versus private control are limited by a lack of data. Few roads in the United States are operated and maintained by a private entity, and even fewer have been under private control long enough to have amassed a number of years of operations and maintenance data. Information is available for only two projects, the Chicago Skyway and the Indiana Toll Road. Both were originally operated and maintained by public-sector agencies and then shifted to private control. That change provides a unique opportunity to compare operations and maintenance performed by public and private managers on the same highway.

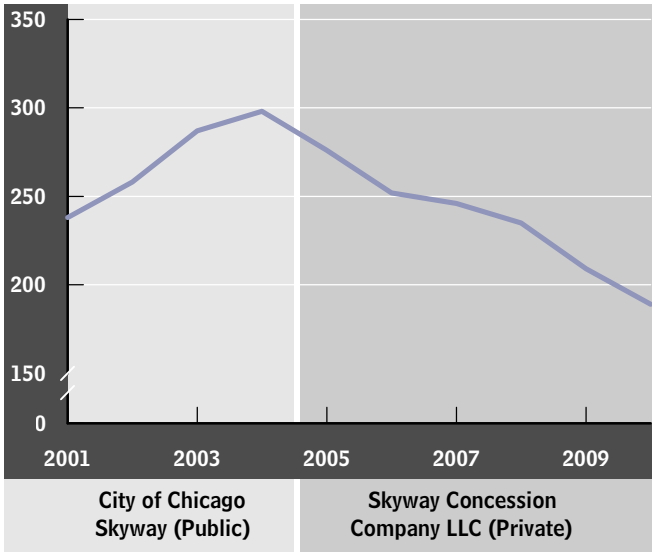
The Chicago Skyway

The Chicago Skyway—an eight-mile toll bridge that connects a major urban expressway to the Indiana Toll Road—was built in 1958; its operations and

Figure B-1.

Public Versus Private Costs per Lane Mile to Operate and Maintain the Chicago Skyway

(Thousands of 2010 dollars)



Source: Congressional Budget Office based on City of Chicago, *Chicago Skyway: Comprehensive Annual Financial Report* (2001 to 2004); and Macquarie Atlas Roads, "Chicago Skyway: Financials" (2005 to 2010); www.macquarie.com/mgl/com/mqa/asset-portfolio/chicago-skyway.

Notes: Lane miles are a measure of road length that reflects the number of miles in each driving lane. For example, two miles of a four-lane highway equal eight lane miles.

The data for 2004 include one-time additional operating costs, such as auditing and legal fees, relating to the transfer of ownership.

maintenance were initially managed by a public authority. In 2005, the city of Chicago entered into a long-term lease agreement with a private partner to operate and maintain the Skyway. That agreement was the first long-term lease of an existing toll road in the United States.

Between 2001 and 2003—a period for which data are available and during which the Skyway was publicly managed—average annual expenditures for operations and maintenance per lane mile totaled $261,000 (in 2010 dollars).[1] During the 2005–2010 period, after the private company took over, such expenditures were an average of 10 percent lower, at $234,000 (in 2010 dollars), than they were from 2001 to 2003 (see Figure B-1).[2]

Some of the decline in average annual costs under the private managers—specifically, for the years 2008 to 2010—could be explained by the recent economic downturn. Passenger traffic accounts for the majority of transactions on the Skyway (a transaction occurs each time a toll is levied); between 2006 and 2010, those transactions fell by 13 percent, from 16.2 million to 14.1 million. Commercial traffic, which includes pavement-damaging heavy trucks, saw a 40 percent decrease in transactions, from 2.2 million to 1.3 million. In addition, operational changes were made, such as technological improvements—a more modern toll-processing system—and a reduction in the number of employees, which could have reduced expenditures for operations and maintenance.

The Indiana Toll Road

The Indiana Toll Road, which was completed in 1956 and is 157 miles long, runs along the northern border of the state, connecting the Chicago Skyway in Illinois to the Ohio Turnpike. In 2006, the state of Indiana entered into a long-term lease agreement with a private firm to operate and maintain the Indiana Toll Road. That transfer of management allows a comparison of costs under public and private control.

Unlike the Chicago Skyway, the Indiana Toll Road has a number of comparable public roads for which data are readily available—specifically, state turnpikes.[3] That second set of data could shed some light on broader economic trends that may affect operations and maintenance costs; it may also help prevent the incorrect attribution

1. Lane miles are a measure of road length that reflects the number of miles in each driving lane. For example, two miles of a four-lane highway equal eight lane miles.

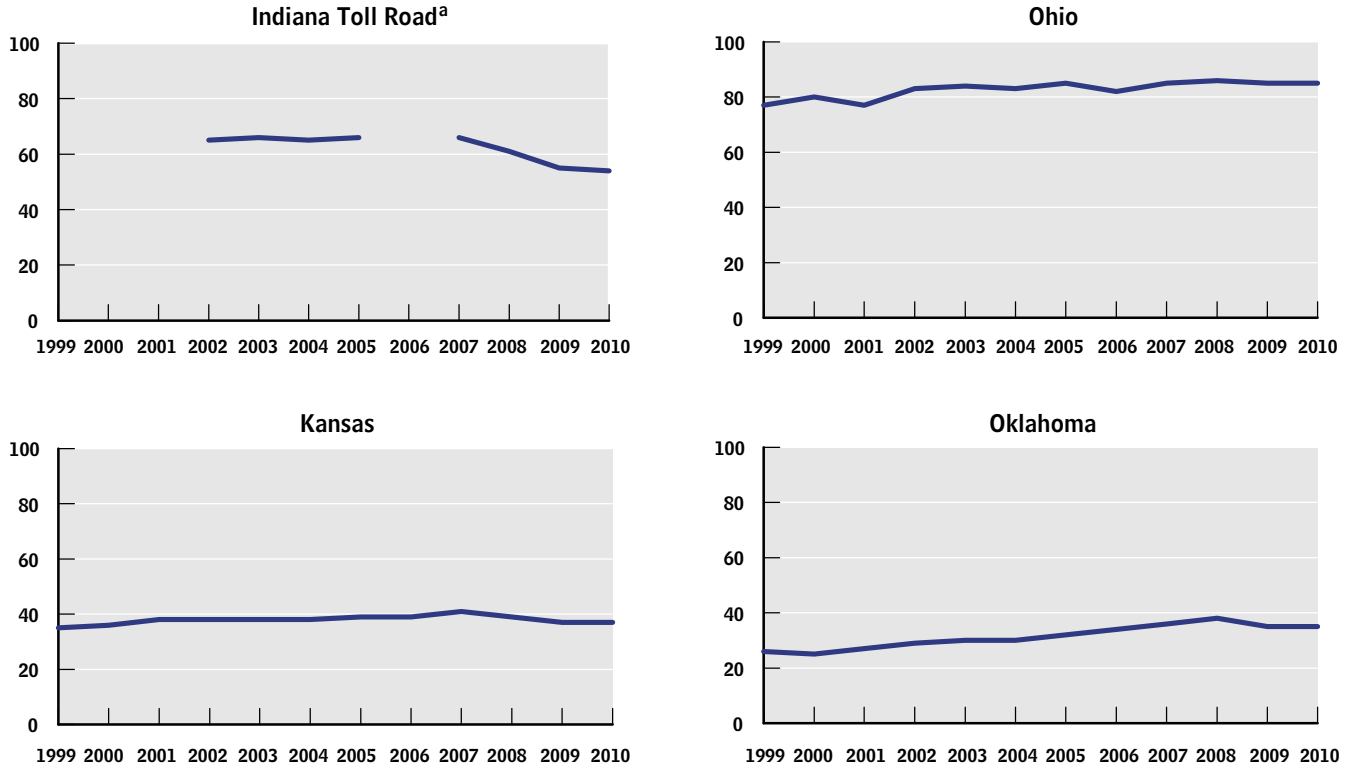
2. Macquarie Atlas Roads, "Chicago Skyway: Financials" (2005 to 2010), www.macquarie.com/mgl/com/mqa/asset-portfolio/chicago-skyway. The calculations presented here exclude data from 2004 because of the one-time additional operating costs—such as auditing and legal fees relating to the transfer of ownership—which were borne by the public managers. Those additional costs drove up expenditures for operations and maintenance for that year to $298,000 per lane mile, according to annual reports for the Skyway produced by the city of Chicago.

3. The Chicago Skyway, which is basically an intracity freeway bridge, has a cost structure different from that of turnpikes, which may comprise hundreds of lane miles of road built mostly overland.

Figure B-2.

Operations and Maintenance Costs per Lane Mile for the Indiana Toll Road and Selected State Turnpikes

(Thousands of 2010 dollars)



Source: Congressional Budget Office.

Note: Lane miles are a measure of road length that reflects the number of miles in each driving lane. For example, two miles of a four-lane highway equal eight lane miles.

a. The public authority for the Indiana Toll Road was the Indiana Toll Finance Authority; the private partner is Statewide Mobility Partners LLC. In 2006, the Indiana Toll Road shifted from public to private management.

of outcomes to public or private management when those outcomes actually stem from other factors.

Costs Under Public and Private Management

From 2002 through 2005, a period of public ownership of the toll road, average annual costs for operations and maintenance were about $65,500 (in 2010 dollars) per lane mile. After the shift to a private manager in 2006, average annual costs for the road between 2007 and 2010 dropped to $59,200 per lane mile, a reduction of almost 10 percent (see Figure B-2). That calculation excludes data for 2006, which marked the transition from public to private management and during which the state paid many of the costs for collecting tolls (such as the costs of labor and of operating and maintaining tollbooths) for the private partner. The calculation also excludes costs for a series of projects, undertaken before the transition year, which widened sections of the roadway from four to six lanes.[4]

The difference in the toll road's costs for operations and maintenance under public and private control, as was the case for the Chicago Skyway, may be due in part to a

4. The costs associated with those expansions fall into the category of major-expense repairs and renovations, which can be considered a subset of more general operations and maintenance (O&M) activities. Because the expenditures for the expansions were not routine O&M charges, they would skew the figures upward, a common problem when evaluating O&M costs without using data on the project's entire life cycle.

greater volume of traffic during the period of public control. The discrepancy may also result from higher toll rates during the period of private control as well as economywide factors, such as the recession in 2008 and 2009.

Comparison with Turnpikes

The Ohio Turnpike probably affords the best comparison with the Indiana Toll Road, for several reasons. It adjoins the Indiana road and, like that highway, is mostly rural, crosses similar terrain, and is subjected to similar weather. One substantial difference, however, between the Indiana Toll Road and the Ohio Turnpike is that the latter encompasses nearly twice as many lane miles.

The United States has many turnpikes, but some are not comparable with the Indiana and Ohio highways—for example, because of terrain (West Virginia), population density (New Jersey), or weather (Florida). Others, such as the Pennsylvania, Kansas, Oklahoma, and Maine Turnpikes, are somewhat different but can nevertheless provide grounds for comparison.

Since the transfer to private ownership, the Indiana Toll Road has seen a gradual drop in its costs for operations and maintenance per lane mile: Costs were $66,300 (in 2010 dollars) in 2005, the last year under public control, and dropped to $54,000 in 2010—a decrease of 19 percent. Over the same period, operations and maintenance costs for the Ohio Turnpike were essentially unchanged ($85,200 per lane mile in 2005 and $85,500 in 2010; see Figure B-2). When results are averaged over four-year periods to smooth out the effects of a potentially abnormal year, the 10 percent decrease in operations and maintenance costs for the Indiana Toll Road under private control compares favorably with costs for the Ohio road, which remained virtually unchanged. Other comparable roads, such as the Pennsylvania, Kansas, Oklahoma, and Maine Turnpikes, also experienced fairly consistent or even increasing average annual costs for operations and maintenance during the 2006–2010 period.

To consider that result a conclusive argument for private operations and maintenance would be premature, however, because other factors—such as a larger decrease in traffic on the Indiana road than on comparable turnpikes—may also have had an effect. Since 2006, the annual number of transactions on the Indiana Toll Road has fallen by 21 percent. By comparison, transactions on the Ohio Turnpike have fallen by approximately 6 percent; the Pennsylvania Turnpike has had nearly the same number of annual transactions; and the number of transactions on the Kansas Turnpike has increased by almost 2 percent. On the Oklahoma Turnpike, transactions went up by 14 percent; on the Maine Turnpike, they went down by 3 percent. Higher toll rates instituted by the private partner probably account at least to some degree for the relatively large drop in the number of transactions on the Indiana road, which has most likely led to a decrease in expenses for operations and maintenance. The reduction in such expenses cannot therefore be conclusively linked to efficiencies resulting from the transfer of control of the turnpike to the private sector.