TOOLKIT

Financial Structuring and Assessment for Public–Private Partnerships: A Primer

Innovative Program Delivery

U.S. Department of Transportation
Federal Highway Administration

Notice

Quality Assurance Statement

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CHAPTER 1

Introduction

The Federal Highway Administration's (FHWA's) Office of Innovative Program Delivery (IPD) assists States and local governments in developing knowledge, skills, and abilities in innovative finance techniques. Public–private partnerships (P3s) are one form of innovative finance. IPD supports the research and development of tools to facilitate consideration and implementation of P3s, assists in building the capacity of practitioner communities, develops and implements Federal policy on P3s, and collaborates with State and local partners to communicate the various aspects of P3s to elected officials, transportation leaders, and the public.

A key IPD activity is the development of a series of primers to (a) assist in understanding P3s, (b) provide key considerations in establishing a P3 program, and (c) show how to compare a P3 procurement option with the conventional approach. This primer is part of the series. Supporting guides and a training program are also being developed. Other primers and a variety of P3 resources are available via the section devoted to P3s on IPD's Web site at http://www.fhwa.dot.gov/ipd/p3/index.htm.

This primer addresses the issue of financial structuring and assessment for P3s. Companion primers on the topics of Value for Money (VfM) analysis and risk assessment for P3s are also available as part of this P3 primer series. P3s, risk assessment, and VfM analysis—and their interrelationships—are briefly described in the following sections.

What Are Public–Private Partnerships?

P3s for transportation projects are drawing much interest in the United States for their ability to access new financing sources and to transfer certain project risks. P3s differ from conventional procurements in which the public sponsor controls each phase of the infrastructure development process—design, construction, finance, and operations and maintenance (O&M). With a P3, a single private entity (which may be a consortium of several private companies) assumes responsibility for more than one development phase, accepting risks and seeking rewards.

Design–build procurement—under which private contractors are responsible for both designing and building projects for a fixed price—are considered by some to be a basic form of P3. Further along the P3 spectrum, the private sector may also assume responsibility for finance and O&M, typically via a long-term (i.e., 30 years or more) concession from the public sponsor. This document, as well as the series of FHWA primers on P3s, is concerned primarily with forms of P3s in which the private sector partner (called the *concessionaire*) enters into a long-term contract to perform most or all of the responsibilities conventionally procured separately and coordinated by the government.

Public agencies pursue P3s for a variety of reasons, including access to private capital, improved budget certainty, accelerated project delivery, transfer of risk to the private sector, attraction of private sector innovation, and improved or more reliable levels of service. P3s, however, like conventional projects, require revenue to pay back the upfront investment. P3s are complex transactions, and determining that a P3 is likely to provide a better result than would a conventional approach is no simple task when considering long-term costs, myriad uncertainties, risks in the present and future, and complicated funding and financing approaches.[1]

1. For more information on P3s, refer to FHWA's primer, *Public–Private Partnership Concessions for Highway Projects: A Primer*, available at http://www.fhwa.dot.gov/ipd/p3/resources/primer_highway_concessions_p3.htm.

Public–Private Partnerships and Risk Assessment

Project risk must be identified, evaluated, and managed throughout a project's life for the project to be successful. Management of risks requires a public agency to proactively address potential obstacles that may hinder project success. P3s are considered to be a form of risk management, because the public sector and private sector parties seek to achieve optimal risk allocation to minimize overall project risks.

Project risk management is an iterative process that begins in the early phases of a project and is conducted throughout the project's life cycle. It involves systematically considering possible outcomes before they happen and defining procedures to accept, avoid, or minimize the impact of risk on the project.[2] Under a P3 transaction, risk allocation tends to be "by exception," so the concession agreement contains a finite list of "relief events" and "compensation events" that are tightly drafted and highly constrained. Everything else is allocated to the concessionaire. In contrast, under a conventional delivery approach, if a circumstance or situation arises that had not been contemplated upfront, that risk (whether or not it could have been foreseen) is owned by the public sector. Risk management follows a clearly identified process, which includes:

- Risk identification.
- Risk analysis.
- Risk response planning (including transfer of risks to the private sector).
- Risk monitoring, controlling, and reporting.

Risk analysis is used in the development of a P3 project for a number of reasons:

- To develop agreement provisions that optimize value for money (discussed later in this chapter).
- To calculate risk adjustments as part of value for money assessments.
- To help determine project contingency amounts.
- To identify and monitor mitigation actions (i.e., risk management).

2. For more information on risk assessment, refer to FHWA's primer, *Risk Assessment for Public–Private Partnerships*, available at http://www.fhwa.dot.gov/ipd/p3/p3_risk_assessment_primer_122612.pdf.

Using Value for Money Analysis to Evaluate Public–Private Partnerships

VfM analysis is defined as "the optimum combination of life-cycle costs and quality (or fitness for purpose) of a good or service to meet the user's requirements" (HM Treasury, 2006), for example, mobility and safety on a highway facility. VfM processes have been designed and used in many countries to help government officials determine whether they are likely to obtain a better deal through a P3 agreement compared with conventional procurement approaches for the same project.

The VfM analysis process is used to compare the aggregate benefits and the aggregate costs of a P3 procurement against those of the conventional public alternative. Risks are present from the early development of a highway project and continue through construction and operation. At the core of a P3 agreement is the allocation of project risks between the public and private partners to minimize the overall costs of risk by improving its management. VfM analysis may be used to assist in the following:

- Development of the transportation investment program by indicating which projects are potentially suitable for P3 delivery.
- Selection of a project's preferred procurement option, that is, conventional procurement or a P3 agreement.
- Selection of the preferred bidder and negotiations with the selected bidder prior to finalizing the P3 agreement.

The methodology for conducting a VfM analysis varies, but as shown in figure 1, its major elements all involve the following steps:

- Creating a Public Sector Comparator (PSC), which estimates the whole-life or life-cycle cost of procuring the project through the conventional approach, including operating costs and costs of risks that are not typically considered in conventionally procured projects (except for major projects covered by FHWA's Cost Estimate Review process, which captures a risk profile and challenges capital cost estimates).
- Estimating the life-cycle cost of the P3 alternative, either as proposed by a private bidder or a hypothetical "shadow bid" at the pre-procurement stage.

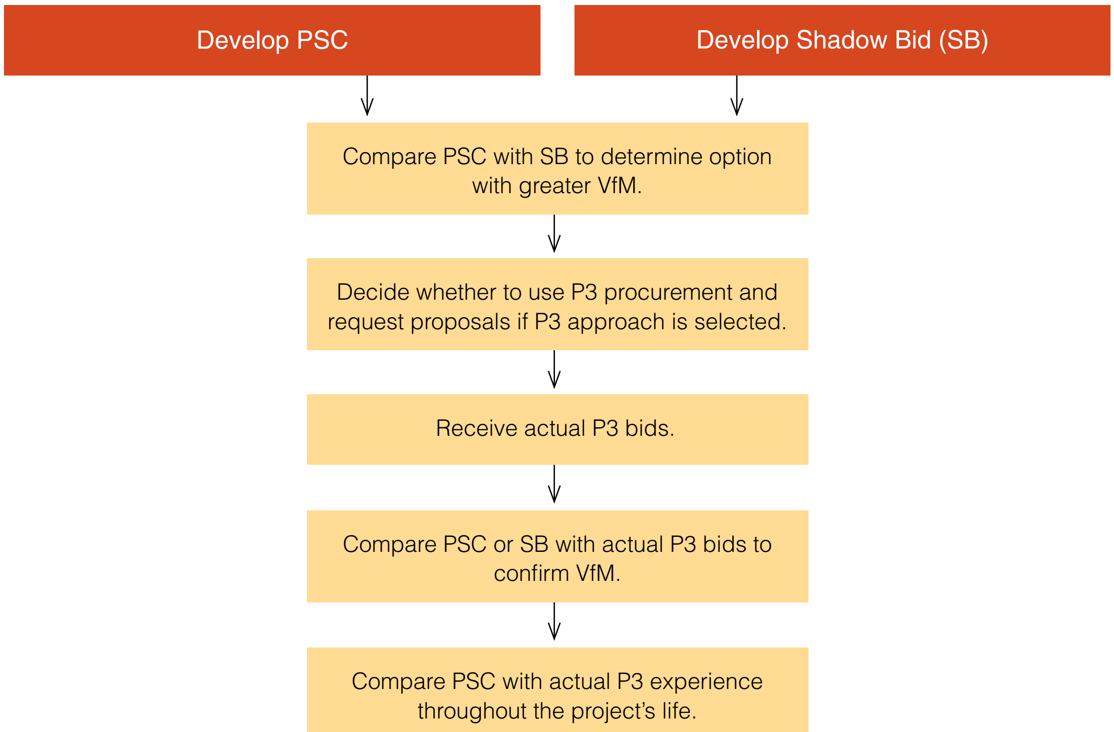


Figure 1. How a Public Sector Comparator (PSC) and public–private partnership (P3) alternative are compared at different stages of project development. VfM = Value for Money.

- Completing an "apples-to-apples" cost comparison, with appropriate consideration of qualitative factors.

The PSC not only provides a means to analyze value for money, but also promotes an understanding of life-cycle costs at an early stage in project development. It may also create confidence in the rigor of the evaluation process to decide whether a P3 would provide better value than would conventional procurement.[3]

Public–Private Partnerships and Economic Assessment

It is important to clarify that VfM assessment is a form of financial assessment of P3s and is distinct from the process of establishing whether a public sector project is a good use of society's resources, which requires a full benefit–cost analysis. Benefit–cost analysis involves a comprehensive assessment of the full range of economic costs, risks, and social benefits and takes into account less quantifiable impacts, including external costs and benefits. Externalities may include increases in economic development, effects on public safety (e.g., reductions in accidents), and environmental impacts. External benefits in excess of external costs may justify public subsidies if revenue from charges to be paid by the facility's users or other beneficiaries is inadequate.[4]

Financial Assessment for Public–Private Partnerships

VfM assessment and economic assessment of P3s are distinct from the process of establishing whether a project is actually affordable to the government, for example, whether any needed public subsidies are acceptable to the government, whether the government is able or willing to borrow the

3. For more information on VfM analysis, refer to FHWA's primer, *Value for Money Analysis for Public–Private Partnerships*, available at http://www.fhwa.dot.gov/ipd/pdfs/p3/p3_value_for_money_primer_122612.pdf.

4. For more information on benefit–cost analysis, refer to FHWA's primer, *Economic Analysis Primer*, available at http://www.fhwa.dot.gov/infrastructure/asstmgmt/primer05.cfm.

amount required, or whether it is able or willing to charge the user fees required. There is no reason to presume that a project that is cost-beneficial or provides good value for money will be affordable or that an affordable project will be cost-beneficial or represent good value for money. Financial assessment, which is undertaken by using financial modeling, helps establish whether a project is actually affordable to the government. A financial model is also used with VfM analysis to model cash flows for the PSC and the shadow bid.

The model typically considers the costs and revenues associated with a project over a defined period in the form of "cash flows." Outputs of the model include key financial indicators that can assist a public agency in determining a project's financial feasibility. Outputs of the model also include indicators that help private bidders determine the potential value of the project and help lenders check the project's capacity to repay debt.

Structure of This Primer

Most P3 projects are financed by using a combination of private equity, debt, and (often) public subsidies. For financial assessment of P3s, it is important to understand these sources of capital, how they are combined (referred to as *financial structure*), and how funds invested in a project are repaid. A considerable portion of this primer (chapters 2 through 5) discusses these aspects of P3s. The basic concepts of project finance for P3s are presented in chapter 2. Because P3s require revenue to pay back investors and lenders, the various types of revenue sources and their advantages and disadvantages with regard to P3s are described in chapter 3. In chapter 4, sources of public sector financing for P3s are discussed, whereas in chapter 5, the various sources of private capital and their incentives and capabilities are reviewed, including how debt repayments may be scheduled to match projected cash flows and project characteristics to make the project financially viable.

Financial modeling and indicators used by public agencies, equity investors, and lenders to assess financial feasibility are discussed in chapters 6 through 9. In chapter 6, the role of financial models is discussed, focusing on what is analyzed and the interpretation of results rather than on the details of the modeling process. In chapters 7 through 9, the metrics used for financial evaluation by the public agency, equity investors, and lenders, respectively, are discussed. Finally, a summary and concluding remarks are provided in chapter 10.

CHAPTER 2

Financing Through Public–Private Partnerships

In conventional practice, public agencies fund transportation infrastructure on a pay-as-you-go basis through receipts from State and local taxes or Federal-aid grants. Otherwise, they issue bonds to raise the funds needed to pay for planned projects.

The pay-as-you-go approach has the benefit of simplicity and allows public agencies to avoid costs associated with borrowing; however, major projects often have to wait until sufficient funds are accumulated or be completed in smaller sections. As a result, the benefits of improved mobility and economic development that come from transportation projects may be postponed. In addition, building a project in sections can be less efficient than building a project all at once, and in times of high inflation, delays in project delivery can lead to higher costs when the project is eventually built.

Financing Through Bonds

Many public agencies issue bonds to raise the capital needed to pay for projects. Bond issuance can help to accelerate the delivery of projects. The interest on most bonds issued by public agencies is tax exempt, providing for lower interest rates; however, excessive bonding can constrain future infrastructure investment by obligating future funding streams to prior projects to the point where it is difficult to undertake new projects. In addition, public agencies may be limited in the amount of bonds they can issue for various legal, political, and financial reasons.

Debt financing has long been recognized as both an effective and an equitable technique for acquiring or constructing long-term assets, because it frees a project's delivery schedule from the constraint of currently available revenues. By accelerating construction or acquisition, debt financing reduces exposure to cost inflation and brings transportation improvements and the associated public benefits online sooner. At the same time, debt financing is equitable because it allocates the capital cost between current and future beneficiaries through annual debt service payments.

Depending on the level of interest rates and the term of the borrowing, however, the financing cost (annual interest payments) can significantly increase a project's resource needs in nominal terms. Note, however, that the present value of the debt service on a bond issue discounted at the effective borrowing rate by definition equals the par amount borrowed. (Discounting is discussed in chapter 7.)

Table 1 illustrates how the financing cost over the term of the bond issue increases the nominal expense as a percentage of project cost. For example, for a 30-year bond issue of $100 with a 5 percent interest cost and a level debt service pattern, the annual payment factor would be $6.51 per year. The sum of those thirty annual payments equals $195.20, comprised of $100 of principal and $95.20 of interest; hence, the 95.2 percent "additional nominal cost."

Table 1. Additional nominal cost of interest expense on long-term borrowing (for a face amount of $100 borrowed).

	Term of Borrowing			
Interest Rate	20 Years	25 Years	30 Years	35 Years
3%	$34.30	$43.60	$53.10	$62.90
4%	$47.20	$60.00	$73.50	$87.50
5%	$60.50	$77.30	$95.20	$113.80
6%	$74.40	$95.60	$118.00	$141.40
7%	$88.80	$114.50	$141.80	$170.30

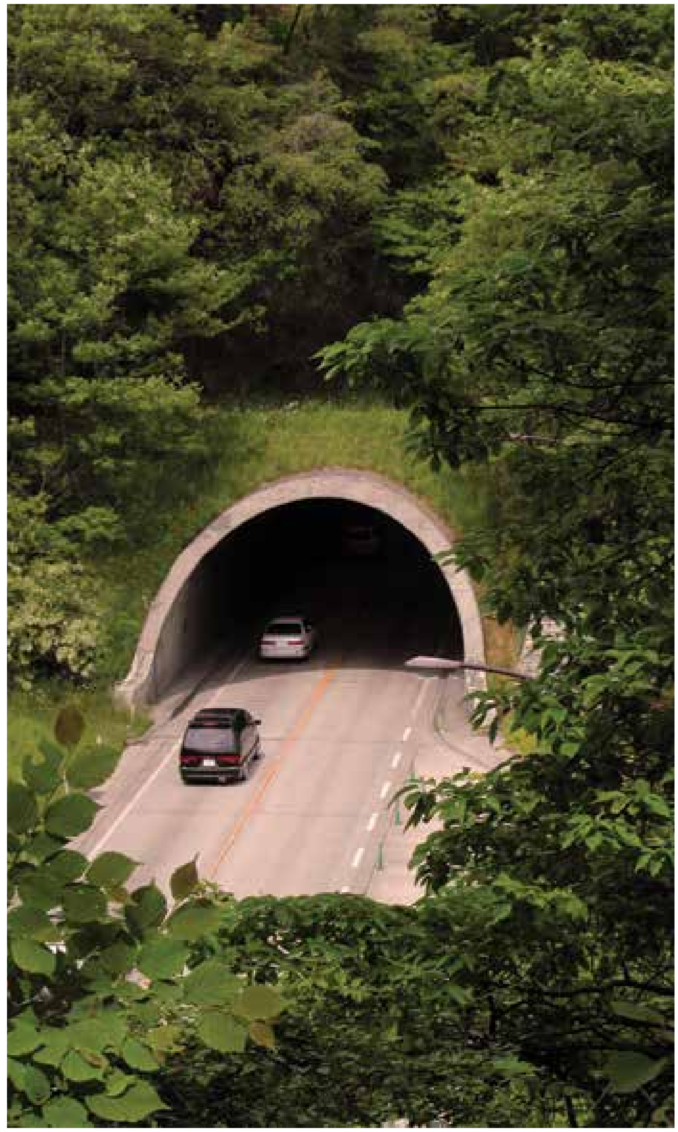
Therefore, the funding strategy can complicate comparisons of different projects in nominal dollar terms. Consider two identical projects of $100 construction cost: One is funded on a pay-as-you-go basis from Federal grants and State match. Another is entirely debt-financed at 5 percent over 30 years. The latter may appear to be nearly twice as "expensive" due to the impact of financing cost.

Financing Through Public–Private Partnerships

P3s allow public agencies to access private equity capital to finance projects. This may be particularly helpful when a toll-based revenue stream is considered to be too risky to support the full amount of the upfront investment required. P3s can accelerate the delivery of necessary projects by helping public agencies raise the upfront capital necessary to construct a major infrastructure project all at once rather than in stages. In some cases, private capital can mean the difference between delivering a project and having no project at all, that is, the "no build" alternative.

Although accessing private capital to finance transportation projects may help a public agency deliver needed transportation projects, it does not come without cost. The capital generated from private finance must be paid back with commitments of a long-term revenue stream to repay lenders and private investors—who typically demand a higher rate of return than would investors who are satisfied with the interest rates in tax-exempt municipal bonds—because of the higher risks they bear as well as the taxable nature of the dividends paid to equity investors and (often) the interest on debt. Therefore, the cost of private financing is generally greater than that of public financing.

With a form of highway P3 called a *concession* or DBFOM (i.e., design–build–finance–operate–maintain), a concessionaire invests its own funds (known as *equity*) and borrows additional funds (known as *debt*) to pay for the construction of a highway project. The concessionaire maintains and operates the project for a specified period and expects to be repaid for its investment in the project over the period of the concession. If the facility is already constructed (i.e., a *brownfield project*, such as an existing toll road), then the concessionaire uses the combination of equity and debt to pay the public agency for the right to operate the facility for a specified period of time and to collect tolls.



Project Finance

Project finance is a specific type of financing through which an expected future revenue stream generated from users of a project or committed by a public agency is the primary means for repaying the upfront investment needed to fund it. Project financing is also known as *non-recourse financing* because, unlike other types of financing (e.g., corporate financing), the project's lenders have no recourse or only limited recourse to the shareholders of the concessionaire in the event of a default on the debt. Private firms often use non-recourse project financing for large high-risk projects, because it can help to insulate them from financial risks associated with the project. The cost of capital for a P3 will be higher than with public sector borrowing, because lenders to the government are not taking any significant risk

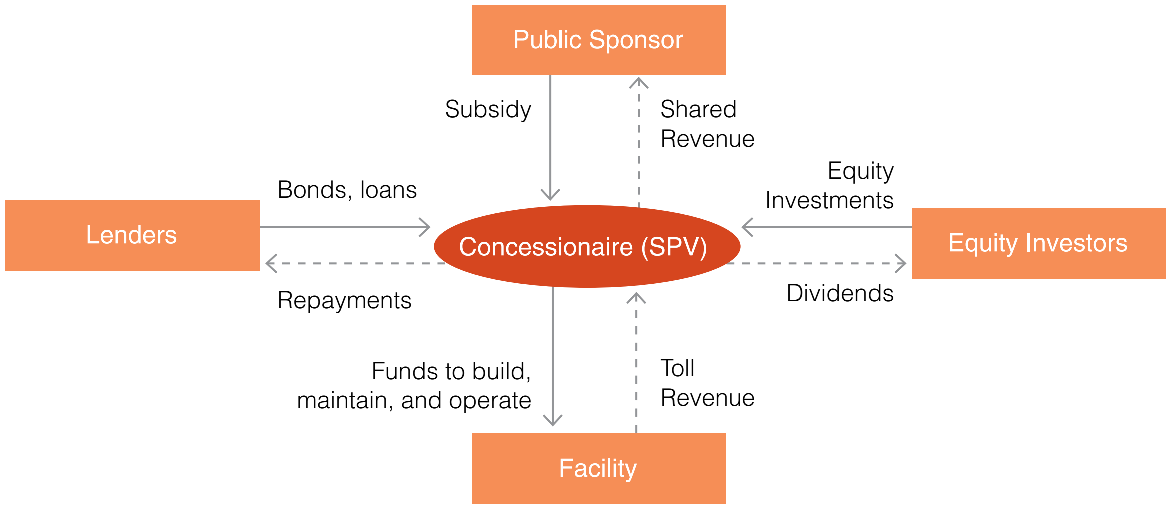


Figure 2. Simple public–private partnership financing structure for toll concessions. Solid lines = cash flows into the project. Dotted lines = cash flows out of the project. SPV = Special Purpose Vehicle.

with their money, whereas lenders to a concessionaire are obviously taking a greater risk.

The typical financing structure for tolled P3 projects is depicted in figure 2. Although a single company may bid on and develop a project, generally several companies form a consortium to develop the project. To make a clear separation between the members of the P3 consortium and the project itself, a Special Purpose Vehicle (SPV) or project company (i.e., the concessionaire) is created after the public agency has awarded the project. The members of the consortium then become the shareholders of the SPV, and their liability is limited to the amount of shared capital they have invested in the new company.

The concessionaire enters into a P3 agreement with the public agency to implement and operate the project. By using project financing, it structures and raises funds from investors and lenders based on the project's future net revenue stream or net cash flows. The project's projected net cash flow (after deducting operating costs and tax payments) must be sufficient to service debt and provide a return to equity. Public agencies may provide direct funding or financing support, guarantees, or other risk mitigation measures.

Revenue from the transportation project is typically channeled through the concessionaire. The cash flow is structured so that accounts for project costs and reserve funds, as well as accounts to repay lenders and investors, are sequentially funded. This is commonly referred to as a *cash flow waterfall* (see figure 3). The cash flow waterfall defines the order of priority for project cash flows as established under the loan and financing documents. In a typical cash flow waterfall, dedicated revenues are used to pay for project costs and debt repayments before other parties derive benefits from the project. This ensures that project debt and maintenance are covered before surplus revenues are used to pay back investors or are shared with the public sector.

Project finance is a useful tool for companies who wish to avoid issuing a corporate repayment guarantee and prefer to finance the project from its balance sheets. Although project finance can be used for all types and sizes of projects, it is primarily used to finance more capital-intensive projects, such as major highway projects. The transaction costs related to implementing project finance structures are high, making the use of this type of financing inappropriate for smaller scale projects.

Cash Flows for Life-Cycle and Financing Costs

Life-cycle costs are the sum of all project elements (including costs of risks) anticipated throughout a project's life. This means accounting for not only a project's construction or capital expenditures (known as *capex*), but also for the costs associated with operating and maintaining it (known as

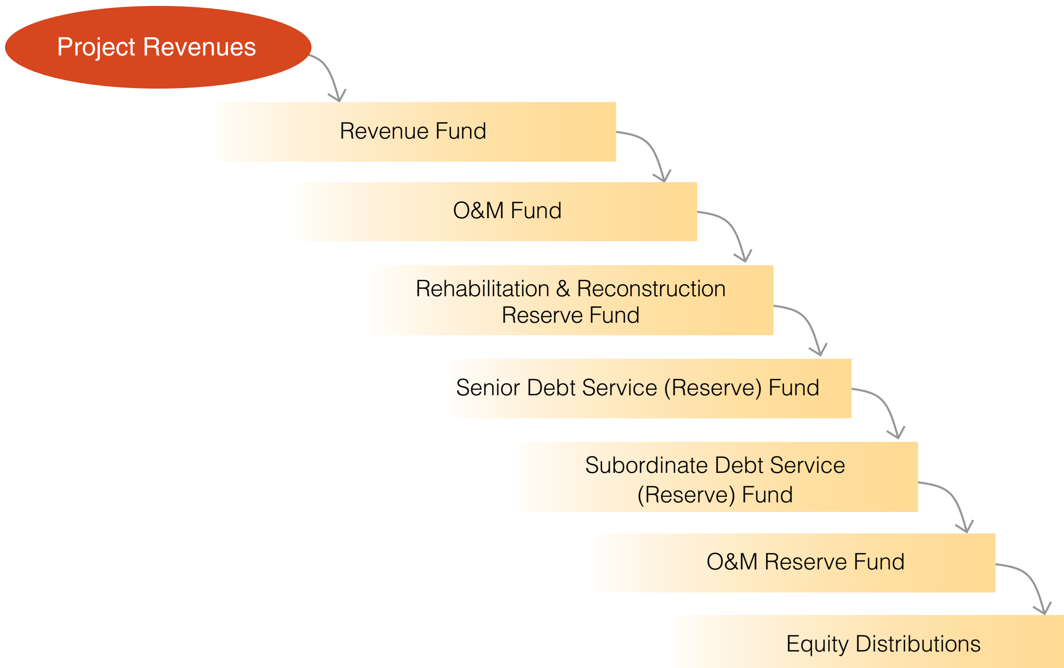


Figure 3. Typical cash flow waterfall. O&M = operations and maintenance.

opex) for the term of the concession. Costs for project development (including procurement costs) are also included.

A new project is characterized not only by large-scale capital costs, but also by a variety of other expenses over the decades of its useful life. Maintaining a facility throughout that time presents significant costs, which will be incurred as part of the concession agreement. These and other expenses can be difficult to quantify with certainty.

The financial model must include estimates of all of the life-cycle costs, including financing costs. Some of the items that are included in the project's cash flow analysis are listed in table 2.

Cash Flows for Payments to Concessionaires

P3s are commonly classified by their payment mechanism. The three most common compensation arrangements in P3 concessions are:

- *Toll concessions*, in which the concessionaire receives compensation by obtaining the right to collect the tolls on a facility.
- *Shadow toll concessions*, in which the concessionaire receives a set payment from the public agency, called a *shadow toll*, for each vehicle that uses the facility.
- *Availability payment concessions*, in which the concessionaire receives a periodic availability payment from the public agency based on the availability of the facility at the specified performance level.

Toll Concessions

In a toll concession, the concessionaire collects tolls on the facilities. Toll revenues are used to pay for project expenses and returns to equity. The toll rate that the concessionaire is allowed to charge is typically defined in the P3 agreement—the agreement often caps the amount by which a toll rate can be increased over time. In the case of congestion-priced facilities, in which toll rates are often tied to mobility performance targets and may not be restricted, P3 agreements will typically limit the potential for excess profits to the private sector through revenue-sharing mechanisms.

Toll concessions are often referred to as *revenue risk concessions*, because the concessionaire accepts both the downside and upside risks of uncertain revenues. Forecasting

Table 2. Cash flow elements for life-cycle and financing costs.

Cost Item	Description
Capital costs	Referred to as *capex*, it includes costs for development of the project, including planning, environmental documents, design and procurement, right-of-way purchase, and construction costs. These costs are incurred in the first few years of the concession period (or term of the contract).
Operations costs	Day-to-day costs of operating the project, such as snow and ice removal.
Maintenance costs	Items such as replacement of lighting.
Reconstruction and rehabilitation costs	Items such as bridge or pavement replacement, which are included as capex.
Overhead costs	Items such as administrative costs, office space, supplies, employee salaries, etc.
Financing costs	Costs associated with the interest charged on public or private debt, returns to private equity, as well as other costs, such as arrangement fees and commitment fees.

demand on new toll roads or lanes is difficult, and revenue projections are very uncertain. More speculative investors may be attracted to the potential for extra profits to be gained if demand for a facility is higher than what is anticipated. Recently, however, investors have been less willing to take on revenue risk. To address their concerns, the availability payment approach (discussed in the following text) has been used.

Innovative contract arrangements have been used in other countries to enable sharing between the public and private partner of the risks associated with uncertain future toll revenues. They include *dynamic concession terms* and *revenue bands*. With dynamic concession terms, the term of the concession ends when a specified net present value (NPV) of the toll revenue stream is reached. (The calculation of the present value of future cash flows is discussed in chapter 7.) With the revenue band approach, upper and lower bounds of the expected toll revenue stream are set contractually. If toll revenue is below the lower bound, the public agency may provide a subsidy to make up a portion of or the entire shortfall, depending on the terms of the agreement. Revenues in excess of the upper bound are shared with or turned over entirely to the public agency. Both approaches reduce the exposure of the concessionaire to revenue risk.

When a project's revenue stream is not sufficient to repay capital investment, the public sector may need to provide financial support to the project by participating in the initial funding for construction or by supplementing the project revenue stream during the operational phase by using its own tax-based resources. Public sector participation in the initial funding could involve providing capital grants to fund parts of the project, providing subsidized or "subordinated" loans (i.e., loans whose debt service is paid only after the debt service of "senior" debt is paid), or providing tax advantages, including tax-exempt debt. These elements are discussed further in chapter 4.

Shadow Toll Concessions

Under this form of concession, the concessionaire receives a set payment for each vehicle using the facility, known as a *shadow toll*. In a shadow toll concession, the public sector transfers traffic risk to the concessionaire so that the concessionaire still has strong incentives to provide high-quality service levels that attract traffic. Shadow toll payments may be adjusted based on performance or based on preestablished floors and ceilings.

Shadow toll concessions have been used extensively in the United Kingdom, and in the United States, they have been used in Texas in "public–public" partnerships (under the term *pass-through tolls*) to repay local agencies for their upfront investments in a project. The advantage over real tolls is that traffic diversion to non-tolled facilities is avoided, because motorists themselves do not pay tolls. The disadvantage is that revenue to repay the concessionaire's investment must come from other public sources, which may be constrained. In addition, the public agency loses cost certainty; however, the upper bound of the public agency's cost is usually known because most shadow toll agreements cap payments.

Availability Payments

With this approach, the public agency provides periodic payments to the concessionaire on the condition that the facility meets defined performance specifications. Revenues received by the concessionaire are not dependent on tolls. If the project is a tolled facility, the public agency may retain revenues from tolls.

Availability payments may be used if the public sector wishes to retain traffic risk to attract more bids or because the private sector would otherwise demand a high-risk premium. To determine the amount of the availability payment, private entities submit bids based on the annual payment they would require to design, build, finance, operate, and maintain the facility. Availability payments may also be used in cases in which tolling is infeasible. If this is the case, the public sector will have to identify an alternative source of revenue to make the payments.

On toll-based projects, availability payments eliminate the public relations risk related to a private firm potentially reaping windfall profits if toll revenues are higher than what is anticipated. (As discussed earlier, this risk can also be mitigated through revenue-sharing provisions that come into play if toll revenues exceed pre-defined thresholds.) In the case of tolled managed lanes, public agencies may choose to use availability payments to retain the ability to dynamically manage toll rates to optimize traffic flow on both the managed lanes as well as the adjacent free lanes; however, although toll revenues will offset the obligations for availability payments, lower than expected revenues may limit the public agency's future financial flexibility.

Performance-based availability payments and traffic-dependent payments (i.e., shadow tolls) in effect allow public agencies to use the P3 as an alternative to direct government borrowing, although use of such P3 arrangements affects their credit capacities less than does direct borrowing. The effects on the public sector's credit rating will be minimal or non-existent when project-based revenues (e.g., tolls) are the sole source of repayment with or without public operational subsidies.

CHAPTER 3

Sources of Revenue

Project revenues for P3s can come from various sources. A common source of revenue for a P3 project is project tolls. Toll-based P3 projects may be undertaken with minimal financial contributions from the public sector. The private sector may agree to design, build, finance, operate, and maintain a project in exchange for the future revenues derived exclusively from the project. The public sector effectively transfers demand risk—the risk that use of the facility will be less than expected—to the private sector. If expected demand for a facility does not materialize, private investors stand to lose some or all of their investment.

Public agency contributions to a P3 project can also be derived from various non-toll revenue sources. Typical revenue sources include State and local gas and sales taxes, as well as Federal-aid funds. P3s may also be structured to take advantage of non-conventional revenue sources, such as local option taxes, parking and other fees, value capture strategies, and ancillary revenues; however, non-conventional revenues may be viewed by potential investors as less stable sources of revenue and, as a result, may be more difficult to use as a source of repayment. In general, the broader the base from which a revenue source is derived, the more stable the revenue source. For example, statewide sales taxes and gas taxes are generally considered more stable than are local property taxes.

A discussion of the advantages and disadvantages of typical revenue sources from a project finance perspective is presented in table 3. The list in table 3 represents some of the revenue sources available today. Their relevance may change over time, for example, fuel taxes are the main revenue source for highway and transportation investments, but their yield is declining due to the introduction of more fuel-efficient vehicles and alternative fuels. Mileage-based user fees are being explored to replace fuel taxes over the long term.

Value Capture

Value capture is an innovative revenue-generation tool that may be either project specific or programmatic in nature. *Project-specific tools* include those that are typically applied to specific development projects, such as:

- *Special assessments*, that is, special charges imposed on property close to a new facility. The assessment is levied only against those parcels that receive a special benefit that can be clearly identified and measured.
- *Tax increments*, that is, taxes levied on the future increment in property value within a development or redevelopment project to finance infrastructure improvements.
- *Negotiated exactions*, such as in-kind contributions to local roads, parks, or other public facilities, or in-lieu fees, as a condition of development approval.
- *Joint development*, involving the development of a transportation facility and adjacent private property with a private sector partner that is either providing the facility or making a financial contribution to offset its costs. The development that occurs in the vicinity of a transit or highway facility is configured differently than it otherwise would be were the facility not present. There are many examples of joint development at transit rail stations. On the highway side, a form of this approach is represented by the development of

Table 3. Typical project finance revenue sources.

Revenue Source	Advantages	Disadvantages
Tolls	• Direct user fee; may create stronger performance incentives for a facility operator. • Revenue risk can be transferred to the private sector. • Tolling structure may include market pricing mechanisms that create economic benefits.	• Traffic and revenue forecasts can fall short of actual revenues. • Costs of collection may be higher than other revenue sources. • Few facilities can be fully financed by using toll revenues alone; most projects will require a combination of revenue sources to work.
State fuel taxes	• Revenues are not directly associated with the use of a specific project but related to general use of the highway network; therefore they may be relatively stable. • Low cost of collection.	• Yield declining over time because they typically do not increase to compensate for inflation and improved fuel efficiency.
Federal-aid highway funds	• Derived from Federal fuel taxes—a relatively stable revenue source and an indirect user fee.	• Yield declining over time, as discussed above. • Federal funds are generally linked to regulations and contracting requirements (e.g., NEPA, Davis-Bacon, etc.) that may be more demanding than the requirements imposed by other revenue sources.
Sales taxes	• Relatively stable revenue source, although subject to influence of economic growth and recession.	• May create market distortions, because they are not aligned with the "user pays" concept. • Local option taxes or those dedicated for specific uses may have a "sunset" date that may not be aligned with the term of the P3 agreement.
Value capture*	• May capture economic value created through infrastructure improvements that is not captured by other sources. • Specific value capture tool can be chosen based on regional or local conditions and project needs.	• Subject to the volatility of the real estate market; rated low by bond rating agencies. • Yield may be low, requiring other revenue sources. • For joint development, there can be concerns about the public sector being a "landlord," and issues related to land taken by eminent domain (if any) being turned over to the private sector for profit.
Ancillary revenues	• Encourage private sector to optimize potential revenue options, reducing the need for limited public resources.	• Yield is relatively low; cannot be considered as stand-alone funding sources but as part of the "revenue portfolio."

*Has not generally been used with highway P3 projects.
Note: NEPA = National Environmental Policy Act, P3 = public–private partnership.

Columbia, MD, where the developer built significant road infrastructure.

Programmatic value capture tools include those that can be applied system-wide within a whole jurisdiction to account for multiple development projects, such as:

- *Split-rate tax*, which applies a higher property tax rate on land than on buildings. These taxes capture the general increase in the value of land due to improved accessibility from transportation networks. This approach is based on the understanding that the property tax is actually two types of taxes: one is based on building values and the other is based on land values. This distinction is an important one, as these two types of taxes have significantly different impacts on incentives and development results. Decreasing the tax on buildings gives property owners the incentive to build, maintain, and improve their properties. As the levy on land values is increased, land speculation and poor land utilization—an example being slum buildings and boarded-up buildings—are discouraged. The signal thus sent to property holders is to either improve their properties or sell them to someone who can do so. Shifting the tax burden in this way discourages land hoarding and encourages good land utilization. It promotes a more efficient use of urban infrastructure (e.g., roads and sewers), decreases the pressure toward urban sprawl (as there is significant infill development), and assures a broader spread of the benefits of development to the community as a whole. This form of taxation has been implemented in Harrisburg, PA, and several other municipalities of Pennsylvania.

- *Transportation utility fees*, which treat transportation networks like a utility. The fees are similar to other local services, such as water and wastewater treatment, that are financed primarily from user charges. Properties are charged fees in proportion to their network use, rather than according to their monetary value, as in property taxation. This mechanism connects the costs of maintaining the infrastructure more directly to the benefits received from mobility and access to the system. The fees are based on the number of trips generated and vary with land use. Transportation utility fees have been used by many cities in Oregon.

Stability and Shelf Life of Revenue Sources

Revenue sources must be stable and generate an adequate yield over the long term to repay P3 debt and equity. Tolls and taxes are usually stable revenue sources, and debt backed by tolls and taxes tends to be rated higher by credit rating agencies. Ancillary revenues—such as revenue generated from right-of-way leases, rest stop concessions, or the sale of advertising or air rights—tend to have relatively low yields. Value capture revenues are typically volatile. These revenue sources are best used in combination with other revenue sources as part of the overall plan for compensation of the P3 concessionaire.

Some revenue sources have a shelf life. Grants and discretionary funds may have time limitations, and some State and local revenue sources (e.g., sales taxes) may expire after a certain date, requiring voter approval to be extended beyond that period. For a P3 project that uses availability payments, the revenues dedicated to make the annual payments must have a life span that extends through the entire concession period. Revenue sources with a shorter shelf life can be used to make payments in the early stages, for example, during construction and the "ramp-up" period for toll roads (i.e., the early period when traffic has yet to rise to forecasted levels). In most cases, several revenue sources are bundled to repay debt and equity in a P3.

CHAPTER 4

Sources of Public Sector Financing

Public sector participation in the initial funding of P3 projects could involve capital grants funded from current revenues by using the pay-as-you-go approach or by bond issuance. The public sector may also provide subsidized loans, loan guarantees, or tax advantages to the concessionaire. These ways of providing financing support are further discussed in the following sections.

Bonds

Public agencies and private firms can both issue bonds to finance a project. Public agencies may issue tax-exempt municipal bonds, which may be paid back by using general revenues or a dedicated revenue stream, such as project tolls. Private firms may also issue bonds that can be paid back through corporate revenues or, in project finance, dedicated project revenues (i.e., project revenue bonds). A common type of revenue bond that private firms use in P3s is Private Activity Bonds (PABs). PABs allow a private firm to issue tax-exempt project revenue bonds for public infrastructure projects.

The interest rates that must be paid on bonds are determined by market demand. That demand is heavily influenced by the credit ratings of the underlying debt as determined by rating agencies (if the bond will be repaid through project revenues) or by the issuing of government's credit history and financial circumstances. Rating agencies evaluate a wide variety of potential risks associated with the bond issuer and the project's projected costs and revenues before applying a credit rating. The range of "investment grade" credit ratings assigned by the three major rating agencies is shown in table 4. (Bonds rated below these grades are considered "junk bonds.")

An example of how different credit ratings and maturities may influence the interest rates, or *yields*, demanded by the market is shown in figure 4. It is typical that the longer the term and the lower the credit rating, the higher the interest rate demanded by the market.

Table 4. Investment grade ratings.

Standard & Poor's	Moody's	Fitch
AAA	Aaa	AAA
AA+	Aa1	AA+
AA	Aa2	AA
AA–	Aa3	AA–
A+	A1	A+
A	A2	A
A-	A3	A–
BBB+	Baa1	BBB+
BBB	Baa2	BBB
BBB–	Baa3	BBB–

Municipal Bonds

Funding from bonds may be used by a public agency to provide a capital investment subsidy to a concessionaire. Bonds issued by State or local governments are termed *municipal bonds*. Bond investors are often willing to accept lower interest rates on municipal bonds because they are generally exempt from Federal income taxes as well as from most State and local taxes in the State of issuance.

There are many different kinds of municipal bonds that can be issued to help finance transportation projects, including general obligation bonds, revenue bonds, and grant anticipation notes. With Federal Grant Anticipation Revenue Vehicle (GARVEE) bonds, future Federal funds are used to repay the debt and related financing costs under the provisions of Section 122 of Title 23, U.S. Code. GARVEEs can be issued by a State, a political subdivision of a State, or a public authority.

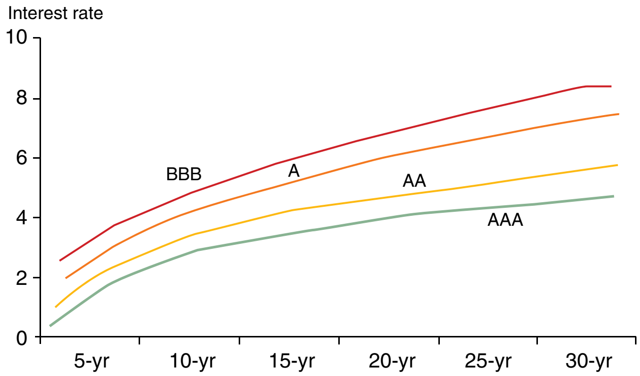


Figure 4. Illustrative tax-exempt yield curves (interest costs).

Revenue Bonds

A concessionaire can use revenue bonds to finance the project. One type of revenue bond commonly used is PABs issued by a public sector conduit. PAB allocations are made by the Secretary of the U.S. Department of Transportation and allow State and local governments to issue tax-exempt bonds on behalf of P3 infrastructure projects. Because they are typically backed by project revenue only, they are financially riskier than are municipal bonds backed by broad-based taxes: If a project fails to produce sufficient revenues, bond holders may not get paid. Therefore, PABs typically receive much lower ratings from rating agencies than do general obligation municipal bonds.

Prior to the 2007–2008 financial crisis, financial guarantees, sometimes called *monoline insurance*, could be purchased to make the issuance of project revenue bonds more attractive to buyers as well as to borrowers (who benefited from lower interest rates on the resulting higher rated debt). The collapse of the bond insurance market has made it more difficult to finance projects through project revenue bonds.

Loans

Loans are rated by using the same credit rating scales as used with bonds. The key difference between loans and bonds is that bonds are tradable instruments (i.e., they can be sold in a secondary market) and have more liquidity than loans. Liquidity reduces the interest rate required by bondholders. Bonds offer advantages over loans, such as greater capacity and longer terms; however, bonds can be less flexible instruments than loans can be, especially with regard to drawdown of debt and repayment schedules. Loans are far easier to structure: They may be drawn down according to funding needs during construction, and it is easier to match debt service with the profile of the project revenue stream, especially for toll-based revenue streams.

Federal Loans Through the Transportation Infrastructure Finance and Innovation Act Program

In recent years, several P3 projects in the United States have been supported by loans from the Transportation Infrastructure Finance and Innovation Act (TIFIA) program. The TIFIA program can issue long-term subordinate loans to revenue-financed projects of national significance. The subordinate position with regard to senior debt means that the TIFIA debt service will be paid only if sufficient cash is available after senior debt service has been paid. TIFIA loans are also particularly attractive for infrastructure financing because they offer:

- *Below-market interest rates*, which depend on the rate on U.S. Treasury debt but are always below rates offered by private lenders.
- *Long grace periods* before loan repayments start, that is, payments may be delayed until 5 years after project completion.
- *Very long maturity* (i.e., term of the loan) that can go up to 35 years.
- *Flexible payment schedules*, that is, payments may be adjusted according to the ability to pay depending on a project's projected cash flows.

Federal Section 129 Loans

Section 129 loans allow States to use regular Federal-aid highway apportionments to fund loans to projects (both toll and non-toll), which can be paid back with dedicated revenue streams. Because loan repayments can be delayed until 5 years after project completion, this mechanism provides flexibility during the ramp-up period of a new toll facility.

Loans From Public Infrastructure Banks

State Infrastructure Banks authorized under Federal law enable States to use their Federal-aid apportionments to establish a revolving fund that can offer low-cost loans and other credit assistance to help finance highway and transit projects, including P3 projects. Some States also have non-Federal State Infrastructure Bank accounts that are funded entirely from non-Federal sources.

CHAPTER 5

Sources of Private Sector Financing

Most P3 projects are financed through the concessionaire by using a combination of private equity and debt. This combination of sources of capital—referred to as *financial structure*—impacts the cost of capital employed for the funding of a P3 investment. The nature and sources of financing will depend on a wide range of aspects, such as the project characteristics and its general risk structure, possible public sector financial support, the ability of the concessionaire to raise capital, the interest of third party investors, the availability of capital markets, and the time available for raising the financing.

Role of Equity Investors

Equity investors assume the highest risks but may also receive the highest returns. Subcontractors who sign contracts with the concessionaire to perform specific services, such as the construction, operation, and maintenance of the project, may contribute an equity stake as well. Other potential investors include financial institutions, such as investment banks, insurance companies, pension funds, foundations, and infrastructure investment funds. These institutions may also serve in the role of a lender, along with commercial banks and public agencies.

Infrastructure investment funds attract money from long-term investors, such as pension funds, insurance companies, and foundations. They are attracted to highway infrastructure projects because they often offer stable cash flow with a moderate risk. They help the concessionaire to structure project financing and make projects "bankable," providing equity (and sometimes subordinate debt) for P3 projects.

Equity investors become owners of the concessionaire (i.e., shareholders) in proportion to their share of capital and expect to be remunerated for their invested capital through the payment of dividends. Dividends are usually paid on a yearly basis from the (after tax) profit generated by the concessionaire after lenders are paid.

Equity investors are exposed to greater financial risk than are lenders because project revenues typically must be used to pay operational costs and repay lenders before equity investors can be paid. If a project does not generate sufficient anticipated revenues, equity investors may lose some or all of their investment. Equity investment also has a potential upside, as surplus net revenue from efficient management of costs or higher-than-expected revenues is captured in dividends to investors (although they may be subject to revenue-sharing provisions with the public sector if revenues are higher than expected). As a result of the risks that equity investors take, the expected rate of return on equity may be significantly higher than the expected rate of return on debt.

Equity investors may also receive tax benefits from their investment. The tax benefits of equity investment, that is, depreciation deductions that shield other taxable income, may account for 10 percent or more of the project's value to the investor. These tax benefits vary over the period of the agreement and may be factored into the bids of project sponsors.

Role of Private Lenders

Private debt is mainly made available by commercial lenders through bank loans or by the capital markets through bonds. Subordinated debt can also play a limited role in financing P3 projects. Maturity (i.e., term of the loan or bond) and interest rates depend on the project specifics.

Private lenders are often investment or commercial banks that specialize in project finance. They tend to be more conservative and have a lower risk tolerance than do equity investors and seek a fixed rate of return, that is, a return with no upside potential. They require lower rates of return than do equity investors but seek to structure deals that minimize their risk by ensuring that they have first call on the net cash flows of a project.

Lenders undertake extensive and detailed reviews of the project's financial model (discussed in chapter 6) and require investment grade traffic and revenue studies (for toll concessions) to assess the risks of a project and to determine whether it is a good credit risk. They want to see that there is a reasonable expectation that the project can be completed on time and on budget, that the revenues and expenditures are relatively predictable, and that projected net cash flows are adequate to cover debt service payments. If lenders perceive that a project is less risky, they may be willing to lend more. If lenders perceive more risk, then they will demand greater investment of equity, thereby raising the overall cost of the project, because equity requires a higher rate of return than does debt. Lenders maintain oversight responsibilities throughout the term of their loan and may retain "step-in" rights that allow them to take over a project that is not meeting expectations.

Bank Loans

Commercial banks have an interest in being paid back as quickly as possible and often structure loans to encourage refinancing after 7–10 years, which tends to coincide with the initial period of construction and project "ramp up." (*Ramp up* is the period during which traffic demand has yet to rise to the levels forecasted by travel demand models because potential users are not familiar with the new travel option.) As a result, borrowers often seek to refinance their loans after 7–10 years.

The normal approach to arranging a project finance loan is to appoint one or more banks as *Lead Arranger*(*s*). Lead Arrangers may reduce their exposure (i.e., risk that they may not be able to resell the loan) by placing part of the financing with other banks in the market in advance of closing the loan. This loan sale process is known as *syndication*. Some bank loans are rated by credit rating agencies (see chapter 4) to assist in wider syndication.

Taxable Bonds

Buyers of taxable bonds are typically institutional investors, such as insurance companies and pension funds looking for a predictable long-term return on investment. As indicated in chapter 4, bonds offer advantages over commercial loans, such as greater capacity, lower interest costs, and longer terms; however, they can be less flexible than loans can be. An investment bank arranges and underwrites financing. The issuer (i.e., the concessionaire) makes a presentation to a credit rating agency (e.g., *Standard & Poor's*, *Moody's*, or *Fitch*), which assigns the bonds a credit rating (see chapter 4).

Balance Between Private Equity and Debt

Every P3 project *must* bring in equity.[5] Equity plays an important role in strengthening incentives for the private sector to perform efficiently and effectively and can be vital in attracting private lenders to a project. Commercial bankers take comfort from the borrower investing considerable amounts of its own money before borrowing. In addition, if the project gets into financial difficulties and its (resale) value decreases, the equity portion can provide a buffer for the debt providers because the balance of the debt could still likely be paid back from sale proceeds in case of bankruptcy of the concessionaire (although equity investors could lose most or all of their equity).

The amount of equity depends on the maximum amount of debt sustainable by the project, given the revenue stream and risk profile. Projects are structured so that debt service payments can be met by project income under various risk-based scenarios. The equity share can be somewhat lower for shadow toll and availability payment concessions, because the economic risks are much lower than those for toll roads. Toll-based concessions typically require a relatively high level of equity (about 20–30 percent of the total funding needed), whereas projects financed on the basis of a shadow toll payment or availability payment may require only 10–20 percent equity.

The ratio of debt to equity is called *leverage*. Higher leverage helps to ensure a lower cost to the public agency, as illustrated in table 5, which is a simplified example that does not include compounding effects. As shown in the table, if the required return for equity investors is 15 percent, annual net revenue of $100 million is required with a low leverage of 50/50 (debt-to-equity ratio), but only $69 million is required using high-leverage financing of 90/10. If compounding were considered, the differences would be even larger. Availability payment or toll revenue

5. The so-called "63–20 Partnership" structure, which does not require equity, is in effect a public–public partnership.

Table 5. Effect of leverage on revenue required to provide returns to investors.

	Low Leverage	High Leverage
Project cost (in millions)	$1,000	$1,000
(a) Debt	$500	$900
(b) Equity	$500	$100
(c) Return required on equity [(b) x 15%]	$75	$15
(d) Interest rate on debt (per annum)	5%	6%
(e) Interest payment [(a) x (d)]	$25	$54
Revenue required [(c) + (e)]	$100	$69

Note: Dollar amounts in millions.
Source: Adapted from Yescombe, E.R. (2007). *Public–Private Partnerships: Principles of Policy and Finance.* Oxford, UK: Elsevier Ltd.

Table 6. Illustrative example of effect of leverage on returns on equity.

	High Leverage	Low Leverage
Debt (in millions)	$900	$600
Equity (in millions)	$100	$400
Annual net revenue (in millions)	$75	$75
Interest rate on debt	7%	6%
Interest payable (in millions)	$63	$36
Profit (in millions)	$12	$39
Return on equity	12%	10%

Source: Adapted from Yescombe, E.R. (2007). *Public–Private Partnerships: Principles of Policy and Finance.* Oxford, UK: Elsevier Ltd.

requirements would likewise be reduced. Note that the interest rate on debt may be higher when leverage is higher (due to the higher risk for lenders), but the net effect is still favorable with respect to the amount of net annual revenue required to provide for returns demanded by investors.

Equity investors have an interest in maximizing the return on their investment by borrowing as much as feasible, that is, maximizing the leverage of their equity. If equity investors are able to achieve higher lender participation, then they may be able to accept lower revenues and still make the same or higher returns on a percentage basis.

The effect of higher leverage on equity return with a simplified example that does not include compounding effects is illustrated in table 6. For a $1-billion project that achieves $75 million per year in net revenue over the life of the investment, greater leverage, that is, higher levels of debt, lowers the amount of equity that investors must contribute to the project up front. If the investors only have to contribute $100 million, with $900 million covered by debt, then they will realize $12 million in profit once the revenue has been realized and the interest is paid. That represents a 12-percent return on their investment. By contrast, if the equity investors have to contribute $400 million, then they may have lower interest costs due to lower risk to lenders, but the profit of $39 million will represent only a 10-percent return on their investment. In reality, the difference will be greater if compounding effects are considered.

Debt Structuring

Debt may be "structured" or "sculpted" to match project characteristics. This section discusses some techniques used to structure debt over the life of the project to match expected cash flows.

Loan repayments generally begin about 6 months after the construction of the facility is completed and are usually made at 6-month intervals. Project finance bonds are also generally repaid in a similar way to loans. Repayments (known as *debt service*) are normally based on an annuity schedule, that is, with level payments over the life of the debt, similar to payments on a home mortgage; however, there will often be variations in the cash flow (e.g., due to a cyclical maintenance schedule). The loan repayment schedule may need to be sculpted to smooth these variations out and to ensure that net cash flow is always sufficient to make the debt service payments.

For toll concessions, usage levels could be lower than anticipated during ramp up. To provide some flexibility to the concessionaire, lenders may agree to *flexible repayment* by agreeing to two repayment schedules: The first would be the level that the lenders wish to receive if the ramp up is as expected, and the second would be the minimum level of payment required to avoid default by the concessionaire. In the second case, payments in later years would be higher to compensate for the lower payments during the early years.

On some toll projects with a long concession period of 50 or more years, traffic growth may be expected to be slow but steady over the first 15–20 years. With *capital accretion bonds*, interest and principal repayments can be delayed for several years after completion of construction. This is accomplished by capitalizing all or part of the interest on the bond and adding it to the principal amount. The peak loan balance may occur after 15–20 years, and the bond is repaid thereafter.

In markets where lenders are reluctant to lend for the longer term, a *balloon structure* may be used. In the United States, banks provide short-term construction loans, which are refinanced by long-term "permanent" loans or bond issues sometime after construction is completed. Principal repayments after completion of construction are based on a long-term debt service schedule but are cut off after 3–5 years, giving rise to a balloon repayment of the balance of the loan.

Lender Constraints

There are often constraints imposed by lenders that affect debt structure. For example, the lenders' requirements for a *cash flow tail* determine the length of debt financing. The cash flow tail is the period between the scheduled final repayment of the debt and the end of the P3 contract, during which revenues continue to be received by the concessionaire. If the cash flow during the term of the loan is not sufficient to repay the debt, there may still be sufficient cash flow left at the tail end of the P3 contract to ensure full repayment of the debt.

The longer the tail period, however, the higher the availability payments or toll revenues will have to be, because debt will need to be repaid over a shorter period. In addition, equity dividends will be pushed to the back of the P3 contract term, reducing their value because of discounting. (Discounting is discussed in chapter 7.)

In some cases, lenders may require a *cash sweep*. A cash sweep requirement forces all of the cash flow that would otherwise have been distributed to investors to be used instead for debt repayment or placed in a reserve account to secure the debt. It may be used where a balloon payment structure is used to encourage refinancing of the debt well before the final balloon repayment date. It may also be used where there is uncertainty about the growth of future revenues, where lenders are concerned about the tail risk, or where substantial costs are to be incurred a long time into the future, for example, for renewal, replacement, or expansion of the highway facility.

Financial Modeling

Purpose and Use of Financial Models

Bidders, lenders, and the public agency use financial models to determine a project's financial feasibility from their perspectives. Financial models of the project produce indicators that help private bidders determine the potential value of the project, help lenders check the project's capacity to repay debt, and help public agencies to determine the value of the concession or the amount of public subsidy that might be needed. Each party generally uses a financial model to test different scenarios of interest to it and their impacts on the indicators of interest (discussed in chapters 7–9).

A public agency may use a financial model in different ways during the project development and bidding phases. Initially, the public agency may use it to create a shadow bid that attempts to predict the bidder's costs, financing structure, and other assumptions in order to determine its financial feasibility, for example, whether the outcome—in terms of upfront public subsidies needed or amount of toll revenue or availability payments required throughout the P3 term—is likely to be acceptable from the public agency's point of view. For P3s that involve availability payments, the model may be used to calculate the availability payment required to cover capital expenditures (capex), operating expenditures (opex), debt service, and return on investment.

The financial model is used by bidders to structure the proposed financing and review the impacts of different financial options. The financial structure of a project has to be consistent with its risk profile. Financial structures are tested based on scenarios in which various risks occur. Varying input assumptions and different financial structures are tested to assess the effects on the bidder's projected cash flow throughout the project's life cycle.

Lenders also use financial models as part of their "due diligence" process that involves the review and evaluation of project contracts and related risks. After financial close, the model continues to be used by lenders to analyze the changing long-term prospects for the project and risks and to track loan performance. Throughout the term of the P3 contract, the model is used to price compensation payments required by the contract due to variations from base assumptions and to calculate any refinancing gains that are to be shared between the public agency and the concessionaire.

Who Develops the Model?

Financial models are complex and should be left to modeling experts. Because there are three perspectives—those of the public agency, the concessionaire, and the lenders—there could theoretically be three parallel financial models. Although the public agency may develop its own "shadow model" for the purpose of creating a shadow bid for its VfM analysis, a common approach is to use the model prepared by the preferred bidder after calibrating it against the public agency's shadow financial model to ensure that the results are the same for the same assumptions. As an alternative, the public agency could provide a template financial model to be used by all bidders to make comparison among bids easier.

It should be noted that although the data in the model is commercially confidential, for several reasons the model needs to be independently verifiable and not subject to interpretation. The public agency needs to be able to use it to check whether the bid is financially viable. If the model is to be used to calculate availability payments, it needs to be approved by both the concessionaire as well as the public agency. Finally, if compensation is to be required later due to changes, the impact of the changes needs to be measured

against the outcome of the base scenario in the P3 contract to which both parties agreed.

Model Inputs and Outputs

Financial models are built by using a standard spreadsheet program and are usually comprised of separate sheets for a user guide, inputs, calculations, and outputs. All calculations involve estimates of future cash flows; therefore, the reliability of the results depends on the validity of the data and assumptions used as input. Input and assumption sheets in the model gather all the input data necessary for the model, including documentation to back up the data. Inputs include the following:

- Economic data (including inflation rate, tax rate, etc.).
- Capital expenditure data (including bidding and development costs, construction costs and schedule, interest during construction, reserve accounts, and contingency amounts).
- Sources of funds and amounts (including equity, loans, bonds, and public subsidies).
- Financial data (including characteristics of the loans and bonds, which involve interest rate, term, covenants, etc.).
- Operations data (including operation and maintenance costs, renewal and replacement costs, traffic forecasts, and toll rates (or toll revenue), etc.).

Model outputs are summarized in results and summary sheets. They include the financial metrics needed by public agencies, lenders, and equity investors (described in chapters 7–9), as well as annual projections of the following:

- Capital expenditures (capex).
- Drawdown of equity and debt.
- Availability payments or toll revenues.
- Other operating revenues.
- Operating expenditures (opex).
- Taxes.

- Debt repayments.
- Profit and loss account (income statement).
- Balance sheet.
- Cash flow (source and use of funds).

Profit and loss accounts (income statements) and balance sheets are included in the model because tax payments are based on accounting results rather than on cash flow. For example, deductions for depreciation affect the calculation of taxes but not cash flow. The accounting results also affect the concessionaire's ability to pay dividends. A balance sheet is usually presented with assets in one section and liabilities and net worth in the other section, with the two sections balancing. It is a good way to check the financial model for errors, because if the balance sheet does not balance, there is a mistake somewhere.

Sensitivity Analysis

The financial model allows the public agency, equity investors, and lenders to calculate the effects of a series of cases under which the key input assumptions are varied. By using the financial model, it is possible to analyze the impacts of changes in assumptions or parameters on the financial metrics discussed in chapters 7–9. Parameters that may be tested include:

- Concession life.
- Length of the construction period.
- Amount of capital subsidies.
- Amount of fixed annual operational subsidies.
- Equity–debt structure (after deducting capital subsidies).
- Loan maturity period.
- Loan grace period (i.e., the initial period of the loan term during which payments are not required to be made).
- Loan repayment profile (e.g., annuity repayment).
- Discount rate (discussed in chapter 7) for subsidies.

By changing each or all of the above assumptions, it is possible to test the robustness of the financial structure under positive or negative risk scenarios, as related to:

- Higher or lower construction costs.
- Higher or lower operating costs.
- Higher or lower traffic volumes due to changes in either initial traffic or annual growth rates.
- Higher or lower rates of inflation.
- Higher or lower interest rates.

The financial model is generally run iteratively with different financial structures and assumptions to check the effects on the various metrics of interest to public agencies, lenders, and equity investors, which are discussed in the next three chapters.

CHAPTER 7

Financial Metrics Used by Public Agencies

The public agency needs ways to compare bids with one another. There are various approaches for comparing bids involving different measures derived as outputs from the financial model discussed in chapter 6. Some of these require converting future cash flows (i.e., expenditures and income, or costs and revenues) to present values. The method used to do so is discussed first.

Converting Future Cash Flows to Present Values

Comparison of bids requires converting toll revenues or future payments to be made by the public agency to present values. Future cash flows are converted to present values by using a calculation known as *discounting* based on a selected discount rate. The discount rate is effectively a percentage by which a cash flow element in the future (i.e., project costs and revenues) is reduced for each year that cash flow is expected to occur. The discount rate is based on the "time value" of money, that is, it is the rate of return one would expect in exchange for receiving a future payback of dollars invested or lent today.

A discounted cash flow (DCF) analysis allows the calculation of a present value for revenues and costs (i.e., income and expenditures) that are not expected to occur until far into the future. The present value formula to calculate the DCF is simply the cash flow amount (C) divided by the discount rate (R) plus one (1) raised to the power of the number of years (N) into the future. In mathematical terms:

$$\text{DCF} = \frac{C}{(1 + R)^N}$$

A discount rate may be "real" (i.e., not including inflation) and therefore applied to cash flows that do not account for inflation, or they can be "nominal" (i.e., including inflation) and therefore applied to cash flows that account for inflation.

The DCF calculation adjusts the value of a given cash flow element (i.e., revenue or cost) based on the number of years into the future that the cash flow element is expected to occur. For example, a $1-million cost expected 10 years in the future might have an NPV of around $615,000 when using a discount rate of 5 percent. The same cost expected 25 years in the future would have a much smaller discounted present day value of around $295,000.

At an assumed real discount rate of 6 percent and an inflation rate of 2.5 percent, the nominal discount rate may be calculated as follows:

$$\begin{aligned}\text{Nominal discount rate} &= (1 + \text{real discount rate}) \times \\ &\quad\ (1 + \text{inflation rate}) - 1 \\ &= (1 + 6\%) \times (1 + 2.5\%) - 1 \\ &= 8.65\%\end{aligned}$$

Because the present value is a function of the discount rate, it can vary depending on the discount rate selected. On one hand, a higher discount rate will give cash flows expected in the future less value after discounting. A lower rate, on the other hand, leads to higher present values or a greater weight given to future costs and revenues. Consider, as an example, the separate expenditures of $1 million dollars, discounted at 5 percent in one scenario and at 8 percent in a second scenario (see table 7).

For cash flows occurring in the years in close proximity to today, different discount rates produce moderate differences

Table 7. Present value of $1,000,000.

Discount Rate	Today	1 Year	5 Years	10 Years	25 Years	50 Years
5%	$1,000,000	$952,400	$783,500	$613,900	$295,300	$87,200
8%	$1,000,000	$925,900	$680,600	$463,200	$146,000	$21,300
Difference relative to 8%	—	+3%	+15%	+33%	+102%	+309%

in discounted values. In this example, the discounted value at a 5-percent discount rate for a $1-million cash flow 5 years in the future is higher than the value at an 8-percent rate by about 15 percent. The difference is more pronounced as the distance into the future increases. At 25 years into the future, the 5-percent discount rate produces a value twice as large as the 8-percent discount rate. By 50 years out, the 5-percent discount rate produces a value that, although small, is four times as large as that produced by the 8-percent discount rate.

Net Present Value of Public Agency Subsidies

The NPV neutralizes the effects of inflation and the time value of money. When a public agency has to make payments (such as shadow toll or availability payments) to a concessionaire over several years, the NPV of these payments is the real amount of the payments if they were paid in a lump sum at present. Public subsidies for either capital or operating costs may also be provided for a toll concession where it is known that the toll revenue will not be adequate to cover funding required for the project.

Public agencies may use several different discount rates to test their effect on the present values of the metric of interest to them. The discount rate that would likely be given the most weight would be the public sector's cost of capital, that is, the borrowing rate of the specific public agency.[6] Future public sector payments represent a form of repayment for capital expenditures made by the concessionaire at the beginning of the P3 contract period. Because the government often uses additional borrowing to fund incremental capital expenditures, it may make sense to base the discount rate on the public agency's long-term borrowing rate. As indicated in chapter 4, this rate depends on the public agency's credit rating. Higher rated agencies will have lower borrowing rates, and discount rates will therefore be lower.

6. Note, however, that there is an alternative view that, because the public sector's principal source of revenue is taxes, which reduces private citizen/enterprise investment opportunities, public investments ought to account for these private opportunity costs.

Contract Term

A second approach that may be used to compare bids, especially for concessions involving availability payments or tolls, is to fix the level of the availability payment or the toll rates and then ask bidders to bid for whatever term of P3 contract they require. The preferred bid would then be the one requiring the lowest term.

Net Present Value of Revenues

A third approach to evaluating bids is to leave the term open-ended and terminate the contract when the NPV of revenues required by bidders has been achieved. The bidder with the lowest required NPV of revenues wins the bid. As with the first approach, a discount rate would need to be selected to convert future revenues to an NPV.

CHAPTER 8

Financial Metrics Used by Equity Investors

The consortium that bids on the project and its investors expect to receive returns on the equity invested in the project, and lenders expect to receive interest on the money lent to the concessionaire's shareholders. Each party may have its own specific tools to analyze the robustness of a project and decide on the best way of structuring the financing. The indicators that are most commonly used by equity investors are discussed in this chapter, and indicators used by lenders are discussed in chapter 9.

Weighted Average Cost of Capital

In corporate finance, weighted average cost of capital (WACC) is used by companies (e.g., members of a P3 consortium) to determine the feasibility of investment opportunities. The WACC calculates a firm's cost of capital, which is equal to the average return expected from all sources of financing. Each category of capital is proportionately weighted. All capital sources—common stock, preferred stock, bonds, and any other long-term debt—are included in the calculation.

WACC is calculated by multiplying the cost of each capital component by its proportional weight and then summing. WACC is thus the average of the costs of these sources of financing and represents the annual amount the company needs to pay for every dollar it receives in financing. Net cash flows from new investments must at least match this rate of return to preserve the company's value. The WACC, used as a discount rate to discount future net cash flows expected, will produce an NPV estimate of the current value of the company. (The discounting of cash flows to calculate present value is discussed in chapter 7.)

As the name implies, the WACC is an average cost of capital calculated based on market value of equity (E) and market value of debt (D) to finance and operate the company. Simply stated, it is the percentage of the financing that is equity times the return on equity (Re) plus the percentage of the financing that is debt times the return on debt (Rd). The WACC calculation also recognizes the benefit obtained from the tax deductibility of interest payments. The WACC is calculated by using the following formula:

$$\text{WACC} = [E/V \times Re] + [D/V \times Rd\,(1 - Tc)]$$

where:

Re = Cost of equity.
Rd = Cost of debt.
E = Market value of the firm's equity.
D = Market value of the firm's debt.
V = $E + D$.
E/V = Percentage of financing that is equity.
D/V = Percentage of financing that is debt.
Tc = Corporate tax rate.

Thus, if a company is financed 50 percent by equity whose cost (Re) is 10 percent per year and 50 percent by debt whose cost is 5 percent per year, and the corporate tax rate is 35 percent, the WACC calculation would be:

$$\text{WACC} = (50/100 \times 10\%) + [50/100 \times 5\%\,(1 - 35\%)] = 6.625\%$$

WACC is higher for a higher equity-to-debt ratio, because that capital structure uses a higher percentage of expensive equity. In the case of a P3 consortium, the required WACC for the project may be that of the company with the highest WACC.

The cost of debt may be readily established from debt markets or debt providers. The cost of equity requires a much more detailed assessment, because risk is largely supported by the equity of investors. This measurement accounts for both the general risk premium applied to any company compared with investment in government debt, as well as the particular risk premium that the stock market attributes to the company's business (which in the case of a concessionaire is the project risk premium).

Project Equity Internal Rate of Return

This represents the yield of the project for the shareholders through the remuneration of their investment with dividends. The Internal Rate of Return (IRR; r) on equity is calculated on the basis r of the following equation:

$$\sum \frac{(Di - Ii)}{(1 + r)^i} = 0$$

where:

Di is the dividend at year i.
Ii is the amount invested by the shareholders at year i.

The equity IRR is commonly used as a "hurdle rate" for investments. For an investment to be justified, the equity IRR must be above the hurdle rate. The standard approach used by bidders for pricing P3 projects is to determine the leverage and cost of debt and then to apply the required equity return to the balance of funding needed.

The required equity IRR may be used by bidders to calculate the required annual availability payment. It may also be used to calculate refinancing gains (when refinancing gains are to be shared with the public agency) or for compensation for contractual changes required by the public agency during the life of the P3 contract, including early termination of the P3 contract.

Rates of return required by equity investors in a P3 project are likely to be driven mostly by project-specific risks, until the project has been successfully operating for some time. How the required equity return may vary depending on project phase is shown in table 8. Investors may come into projects at different stages and price their required return depending on when they come into the project.

In table 8, the risk-free rate is the WACC of the consortium bidding on a project. Project risk is the risk that applies throughout the project's life. A toll-based concession with high traffic risk would be at the high end of the scale. The phase risk relates to the point where the investor comes into the project. In the United States, the consortium providing equity prior to construction expects roughly a 12–14 percent rate of return on equity.

Project Internal Rate of Return

The project IRR may be used to assess the general financial viability of a project without taking account of its financial structure (i.e., ratio of debt to equity). It represents the financial return or yield of the project regardless of the financing structure. The project IRR (r) is calculated on the basis of the following equation:

$$\sum \frac{Ri - Ii - Ci}{(1 + r)^i} = 0$$

where:

Ri is the operating revenue at year i (after taxes).
Ii is the amount invested at year i.
Ci is the operating cost at year i.
r is the project IRR.

The project is considered to be financially viable when r is above a benchmark rate of return with respect to the project characteristics. For example, if the required return on equity is 12 percent, the required return on debt is 6 percent, and the ratio of debt to equity is 80/20, the required project IRR would be calculated as follows:

$$\text{Project IRR} = (12\% \times 0.20) + (6\% \times 0.80) = 7.2\%$$

Table 8. Project phases and required equity return.

Phase	Risk-Free Rate	Project Risk	Phase Risk	Equity Return
Construction	6%	2–4%	4%	12–14%
Ramp up	6%	2–4%	2%	10–12%
Long-term operation	6%	2–4%	—	8–10%

Source: Adapted from Yescombe, E.R. (2007). *Public–Private Partnerships: Principles of Policy and Finance.* Oxford, UK: Elsevier Ltd.

CHAPTER 9

Financial Metrics Used by Lenders

Three metrics—annual debt service coverage ratio (ADSCR), loan life coverage ratio (LLCR), and project life coverage ratio (PLCR)—are used by lenders to check project capacity to repay debt.

Annual Debt Service Coverage Ratio

The ADSCR represents, *for any operating year*, the ability for the net project revenue to cover the debt. This ratio is determined as follows:

$$ADSCRi = \frac{CFADSi}{DSi}$$

where:

CFADSi = Net cash flow available for debt service at year *i* (i.e., the amount of cash remaining after operating costs and taxes have been paid).

DSi = Debt service required at year *i* (i.e., principal and interest).

The higher the ADSCR, the more attractive the project will be to lenders. Any ADSCR above 1.0 provides a cushion for adverse circumstances that may occur during the project's life. This means that if, for whatever reason, the project revenue is below what has been forecasted at year *i*, the concessionaire should nevertheless be at least able to repay the debt. The minimum required ADSCR is a function of the risk inherent in the project. In general, the minimum required ADSCR is 1.15 to 1.2 for low-risk P3 projects (e.g., those involving availability payments), and it may be as high as 1.5 to 2.0 if revenue risk is high, such as for toll-based concessions.

The ADSCR is the primary determinant of the maximum loan that can be raised against project revenue, as illustrated in table 9. As the table shows, for a pre-debt cash flow of $1,000, the maximum amount of debt that can be raised is $9,833 for a 25-year debt term when the required ADSCR is 1.30. If the cover ratio is reduced to 1.15, the amount of debt that can be raised increases to $11,116.

During their projections, lenders schedule loan repayments (see the discussion in chapter 5) such that projected ADSCR for each period through the term of the loan does not fall below the required minimum at any time.

Table 9. Effect of annual debt service coverage ratio (ADSCR) on loan amount.

Variable	ADSCR Requirement	
	1.30	**1.15**
Debt term	25 years	25 years
Interest rate	6%	6%
Project cash flow before debt service (a)	$1,000	$1,000
Maximum annual debt service [(a) / ADSCR]	$769	$870
Amount of debt that can be raised (based on annuity repayment)	$9,833	$11,116

Source: Yescombe, E.R. (2007). *Public–Private Partnerships: Principles of Policy and Finance.* Oxford, UK: Elsevier Ltd.

Loan Life Coverage Ratio

The LLCR ratio indicates the capacity for the concessionaire to bear an occasional shortfall of cash due to a change in circumstances (relative to the assumptions) in the model while maintaining its debt service through the end of the term of the debt. This ratio is calculated as follows:

$$LLCRi = \frac{NPV\,(CFADSi \rightarrow end)}{NPV\,(DSi \rightarrow end)}$$

where:

$NPV(CFADSi \rightarrow end)$ = Net present value of the cash flow available for debt service from year i to the end of the debt repayment period.

$NPV\,(DSi \rightarrow end)$ = Net present value of total of debt service remaining at year i (i.e., principal and interest).

The project is considered viable for the lenders when the LLCR exceeds the principal amount of debt outstanding for every year of the project life. This means that the concessionaire should be able to maintain its debt repayments if there is a period of cash shortfall. The higher the LLCR, the more attractive is the project to lenders.

The ADSCR and LLCR are used by the lenders to check project capacity to repay debt in adverse-risk scenarios, such as if revenues are below forecasted levels during a recession. The minimum initial LLCR requirement in lenders' projections for P3 projects is typically about 10-percent higher than the required ADSCR.

As part of the lenders' continuing monitoring of the loan, the LLCR may be recalculated throughout the project life to compare the projected operating cash flow for the remainder of the loan term with the remaining loan outstanding.

Project Life Coverage Ratio

Another check made by lenders is whether the concessionaire has the capacity to make repayments after the original final maturity of the debt within the cash flow tail period (see chapter 5) if there are difficulties in repaying all of the debt in time.

The value to lenders of the tail can be calculated by using the PLCR. To do so, the CFADS (i.e., cash flow available for debt service) for the whole life of the project (not just the term of the debt as for the LLCR) is discounted to its NPV, and this figure is divided by the debt outstanding. The minimum initial PLCR requirement in lenders' projections for P3 projects is typically about 15–20 percent higher than the required ADSCR.

CHAPTER 10

Summary

Public agencies pursue P3s for a variety of reasons, including sharing risk with the private sector, access to private capital, reduced upfront costs, accelerated project delivery, design innovation, and improved levels of service. However, P3s—like conventional projects—require revenue to be delivered. *Project finance* is a specific type of financing used for P3s through which an expected future revenue stream generated from a project or committed to a project by a public agency is the primary means for repaying the upfront investment a concessionaire makes to fund it.

In the project development phase, financial assessment helps establish whether a P3 project is affordable to the government. Initially, the public agency attempts to determine the bidder's costs, financing structure, and other assumptions to determine whether the amount of public subsidies, toll revenue, or availability payments required are likely to be acceptable from the public agency's point of view.

In the bidding phase, financial assessment is used by the public agency to review the bidder's financing and the impacts on public agency contributions. For P3s that involve availability payments, a financial model is used to calculate the availability payment required to cover capital and operating expenditures, debt service, and return on investment. After financial close, the financial model continues to be used to price payments to the concessionaire required by the contract due to variations from base assumptions and to calculate any refinancing gain to be shared between the public agency and the concessionaire.

The financial model attempts to address the public agency's constraints with regard to the term of the P3 contract and the amount of public funding available throughout the life of the P3 contract. It addresses lenders' requirements for debt, such as interest rates and term, cash flow tail, and the required coverage ratio of cash flows available to repay debt relative to the amount of debt (both principal and interest), to be repaid throughout the life of the debt. It also addresses the required return on investors' equity. Finally, the model accounts for taxes and other expenditures in calculating cash flows available for debt service.

Although accessing private capital to finance transportation projects may help a public agency deliver needed transportation projects, it does not come without cost. As with any financing, the capital generated from private finance must be paid back with future revenue. P3 agreements often involve the commitment of a long-term revenue stream to pay back lenders and private investors. Private lenders and investors typically demand a higher rate of return than do investors in tax-exempt municipal bonds; therefore, the cost of project financing through P3s is generally greater than that of public financing. Public agencies must carefully analyze these and other tradeoffs when deciding whether to pursue private financing of transportation projects. A VfM analysis can assist in the decision.

Glossary

Bidder—A respondent to a Request for Expressions of Interest or an invitation to submit a bid in response to a project brief. Typically, a bidder will be a consortium of parties, each responsible for a specific element, such as constructing the infrastructure, supplying the equipment, or operating the business. The government normally contracts with only one lead party (bidder), who is responsible for the provision of all contracted services on behalf of the consortium.

Brownfield—Projects that focus on improving, operating, and/or maintaining an existing asset (contrast to greenfield). P3 brownfield projects in transportation typically are long-term operation and maintenance contracts or lease concessions. Blended greenfield–brownfield projects also exist, for example, improving an existing asset by adding new capacity (e.g., more lanes).

Concession Period—Total construction and operating periods.

Concessionaire—Private entity that assumes ownership and/or operations of a given public asset (i.e., train station, bus operation) under the terms of a contract with the public sector.

Contingency—An allowance included in the estimated cost of a project to cover unforeseen circumstances.

CPI—Consumer Price Index.

DB—Design–build. Under a DB, the private sector delivers the design and construction (build) of a project to the public sector. The public sector maintains ownership and operations and maintenance of the asset. *Build* refers to 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.

DBFOM—Design–build–finance–operate–maintain. Under DBFOM, the private sector delivers the design and construction (build) of a project to the public sector. It also obtains project financing and assumes operations and maintenance of an asset upon its completion.

Debt Tranche Interest-Only Period—Interest-only period for project bond.

Debt Tranche Maturity—Maturity date for project bond.

Discount Rate—Percentage by which a cash flow element in the future (i.e., project costs and revenues) is reduced for each year that cash flow is expected to occur.

Discount Rate Nominal—Discount rate that factors in the inflation rate.

Discount Rate Real—Discount rate that does not account for inflation.

DSCR—Debt service coverage ratio.

Finance—Phase or delivery aspect of the project that includes 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.

Greenfield—Projects that focus on developing and/or building a new asset (contrast with brownfield). Many P3 structures are available for greenfield projects, including design–build, design–build–operate–maintain (DBOM), design–build–finance–operate–maintain/manage (DBFOM), and others. Blended greenfield–brownfield projects also exist.

Inflation Consumer Price Index—Used as a base rate for inflation assumptions.

IPD—The Office of Innovative Program Delivery (IPD), a part of the Federal Highway Administration, provides tools and expertise in use of different public–private partnership (P3) approaches.

Leveraging—Degree to which an investor or business is utilizing borrowed money.

Maintenance—This phase includes 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.

Net Present Cost (NPC)—Estimated present value of expected future cash flows associated with PSC and shadow bid analysis without considering revenues.

Net Present Value (NPV)—Present value of the expected future revenues minus the net present cost.

Private Activity Bond—New type of financing that provides private developers and operators with access to the tax-exempt bond market, lowering the cost of capital significantly.

Public Sector Comparator (PSC)—Represents the most efficient public procurement cost (including all capital and operating costs and share of overheads) after adjustments for competitive neutrality, retained risk, and transferrable risk to achieve the required service delivery outcomes. This benchmark is used as the baseline for assessing the potential value for money of private party bids in projects.

Retained Risk—The value of those risks or parts of a risk that government proposes to bear itself under a partnership arrangement.

Revenue Leakage—Assumed annual revenue losses for a tolling facility.

RFP—Request for proposal.

ROW—Right of way.

Risk Allocation—The process of assigning operational and financial responsibility for specific risks to parties involved in the provision of services under P3. See also *risk transfer*.

Risk Transfer—The process of moving the responsibility for the financial consequences of a risk from the public to the private sector.

Routine Maintenance—Work that is planned and performed on a routine basis to maintain and preserve the condition of the highway system or to respond to specific conditions and events that restore the highway system to an adequate level of service.

Technical Risk—Risks arising from deviations from the project's original technical assumptions, specifications, or requirements.

T&R—Traffic and revenue.

Transportation Infrastructure Finance and Innovation Act (TIFIA)—This program provides Federal credit assistance in the form of direct loans, loan guarantees, and standby lines of credit to finance surface transportation projects of national and regional significance (FHWA, 2013).

Transferrable Risk—The value of any risk that is transferrable to the bidder.

Value for Money (VfM)—The procurement of a P3 project represents VfM when—relative to a public sector procurement option—it delivers the optimum combination of net life-cycle costs and quality that will meet the objectives of the project (Virginia Office of Transportation Public–Private Partnerships, 2011).

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