Risk Assessment for Public-Private Partnerships: A Primer

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P3 TOOLKIT

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Table of Contents

Tables

Figures

1 Introduction

FHWA is developing several primers and research reports on various issues surrounding highway Public-Private Partnerships (P3s). This primer addresses *Risk Assessment* for P3s. Companion primers on *Value for Money Analysis* and *Financial Assessment* for P3s are also available as part of this series of Primers. P3s, risk assessment and value for money analysis are briefly described in the following sections.

What are Public-Private Partnerships?

Public-private partnerships (P3s) for transportation projects are drawing much interest in the United States for their ability to access new financing sources and transfer certain project risks. P3s differ from conventional procurements where the public sponsor controls each phase of the infrastructure development process – design, construction, finance, operations and maintenance. 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, operations, and maintenance, typically via a long-term (e.g. 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 where the private sector partner (called the "concessionaire") enters into a long-term contract to perform most or all 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. However, P3s– like conventional projects -- require revenue in order to pay back the upfront investment.

P3s are complex transactions, and determining that a P3 is likely to provide a better result than a conventional approach is not simple. There are many factors that must be considered when determining the best procurement approach for a given project, including long-term costs, myriad uncertainties, risks both now and in the future, and complicated funding and financing approaches. Public agencies may conduct Value for Money (VfM) analyses to compare a P3 approach with a conventional approach.

For more information the reader is encouraged to refer to FHWA's primer on *Public-Private Partnerships*, available at: http://www.fhwa.dot.gov/ipd/p3/index.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, as well as take advantage of opportunities to enhance success or save costs. P3s are considered to be a form of risk management as the public sector and private sector parties seek to achieve optimal risk allocation allowing for the management of risks by the party best able to handle them.

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. 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. Conversely, under conventional delivery approach, if a circumstance or situation arises that had not been contemplated up-front, 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 in Chapter 6);
- To calculate risk adjustments as part of value for money assessments;
- To help determine project contingency amounts; and
- To identify and monitor mitigation actions (i.e., risk management).

For more information on the risk management process for construction, the reader is directed to FHWA's *Guide to Risk Assessment and Allocation for Highway Construction Management* available at: http://international.fhwa.dot.gov/riskassess/pl06032.pdf. Also, a useful resource is the Transportation Research Board's *Guidebook on Risk Analysis Tools and Management Practices to Control Transportation Project Costs* (NCHRP Report 658), available at: http://www.trb.org/Main/Blurbs/163722.aspx.

Note, however, that P3s may be used to manage not just construction risk, but also to address pre-construction (development phase) risks, financial risks, and risks related to the project's life cycle.

Structure of this Primer

This Primer is structured as follows. Chapter 2 discusses how the extent of risk transfer varies by type of project and type of P3 contract. Chapter 3 outlines the key types of risks faced in P3 projects. Chapter 4 discusses analysis of project risks to assess their cost impacts. Chapter 5 explains how risks are optimally allocated between the public and private sectors to minimize total project life-cycle costs. Chapter 6 discusses how costs of risks under conventional and P3 procurements may be incorporated into Value for Money analyses often used to compare the two procurement options. Chapter 7 concludes with a summary.

2 Project Risks in Public-Private Partnerships

This Chapter discusses how the extent of risk transfer varies by type of project (i.e., scope) and what phases and functions of a project are covered by a P3 contract.

Extent of Risk Transfer by Project Type

P3s can involve existing "brownfield" projects (which is the lease of an existing facility), or they can involve proposed new facilities, which are known as "greenfield" projects.

For *brownfield* projects, a public entity generates a capital inflow or debt payoff by transferring the rights, responsibilities and revenues attached to an existing asset to a private sector entity for a defined period. Risks to the private entity are lower, since little or no new construction is involved and traffic volumes and toll revenues can be more accurately projected based on existing traffic patterns.

In the case of a *greenfield* project, a public agency transfers all or part of the responsibility for project development, construction and operation to a private sector entity. Greenfield projects generally present higher risks to both parties than do brownfield projects because of the greater uncertainty surrounding traffic forecasts, permitting and construction. Given the complex role that revenue risk plays in a P3 deal, this particular risk is generally separated from other risks in considering whether to have a toll concession or an availability payment concession (discussed later in this Chapter).

In the case of a *hybrid* project, an existing facility is in need of capital improvement (usually either extension or expansion), and a private sector entity is brought in to finance the necessary improvements and to operate the facility. While traffic risks may be lower for a hybrid project relative to a greenfield project, they may still be significant due to difficulties in forecasting the users' willingness-to-pay any new or substantially increased tolls that may be proposed to pay for the project. Also, there may be contentious issues with regard to latent defects.

Extent of Risk Transfer by Type of Public-Private Partnership

P3s encompass a variety of contractual structures, with various degrees of risk transfer to the private sector. Table 2-1 illustrates the extent of risk transfer in the most common forms of project procurement.

The P3 structure with the lowest level of private sector involvement is *Design-Build (DB).* Under DB, the same firm is responsible for both design as well as construction of the facility, whereas under the conventional Design-Bid-Build (DBB) approach, separate firms are responsible for design and construction. For both structures, the public agency remains responsible for financing and operating the project. However, a greater amount of risk is transferred to the private sector entity under a DB structure, as the contractor provides a maximum price for both design and construction. The principal reason that DB transfers significant risk away from the public owner is that many construction claims arise due to issues at the design/construction interface, including design errors and omissions and constructability problems. The DB form of contract eliminates the source for construction claims of this type by introducing single source accountability.

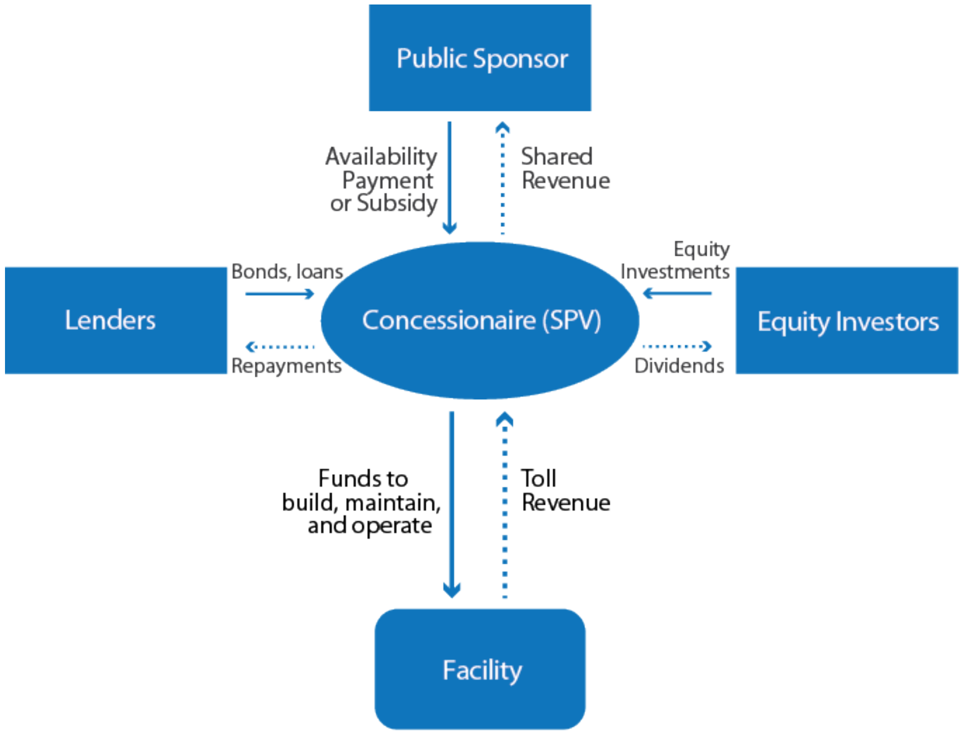
Table 2-1. Procurement Models and Range of Risk Transfer to Private Sector

P3 Structure	Design Risk	Constr. Risk	Financial Risk	O&M and Rehab Risk	Traffic Risk	Revenue Risk
Traditional Design-Bid-Build		X				
Design-Build (DB)	X	X				
Design-Build-Finance (DBF)	X	X	X			
Design, Build, Finance, Operate and Maintain (DBFOM)	X	X	X	X	Yes, if toll or traffic-based payment	Yes, if performance -based payment

With a *Design-Build-Finance (DBF)* structure, the private sector entity is in charge of financing and building the project, but leaves the O&M of the facility to the public agency.

Design-Build-Finance-Operate-Maintain (DBFOM) adds private financing to the design, construction, and O&M of the project (see Figure 2-1). The public agency may have to provide a public subsidy to the project which may require use of bond proceeds or budgetary authority, but the public agency will not usually finance the entire project under this P3 structure. This form of P3 is also called a “concession.”

Figure 2-1. P3 Structure under a DBFOM Concession



In the case of a *toll-based DBFOM concession*, the private sector entity shoulders a considerable amount of risk linked to the uncertainty of traffic over the life of the project. The investment decision and the financing structure are determined based on traffic projections; if actual traffic is lower than projected, the private sector partner is exposed to financial loss and to the risk of defaulting on project debt. If traffic and revenue are higher than expected, the private partner could make super profits. In order to protect against this, a revenue sharing clause is usually included in the P3 agreement. In some P3 agreements, the concessionaire may be protected from revenue shortfalls when lower than expected traffic is realized by allowing for "*flexible term*" concessions and "*revenue bands*." With flexible term concessions, the term of the concession ends when a specified net present value (NPV) of the gross toll revenue stream is reached. 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 sponsor provides a subsidy to make up some of or the entire shortfall. On the other hand, revenues in excess of the upper bound are shared with or turned over entirely to the public sponsor.

Excessive traffic risk can deter private sector entities or reduce their ability to secure financing. For greenfield projects, traffic volume is more difficult to accurately forecast than for already existing brownfield projects. Public agencies may therefore modify the P3 structure for greenfield or hybrid projects to offer guaranteed payments to the private sector partner. A *shadow toll-based concession* allows the public agency to compensate the private sector entity based in part on a "shadow toll" or fee[1] paid by the public agency for each vehicle that uses the facility. Such payments generally have a fixed component that guarantees partial revenue, even if traffic volume were to be below projections.

With an availability payment-based concession, the public agency retains the traffic risk by making payments directly to the private sector partner based on the availability of the facility rather than on the number of vehicles. Payments are contingent on achievement of pre-agreed performance standards. However, the private entity is exposed to long-term appropriations risk. U.S. examples include the I-595 express lanes in Florida and the Presidio Parkway in California.

[1] A shadow toll is called a "pass through toll" in Texas and used primarily for inter-agency agreements rather than concession agreements

3 Types of Project Risks

All projects, whether undertaken using conventional procurement methods or using a P3 approach, have known risks, "known unknown" risks and unknown risks. *Known risks* are risks that have been identified. Identified risks need to be proactively managed throughout the project life cycle by identifying who owns the management of those risks and by what the risk entails, its triggers, and contingency plans that would prevent those risks from occurring or that would lessen the impact on the project should they occur. At times, the risks may simply be accepted by a project if the cost to avoid or mitigate the risk is more than cost of the potential consequences.

Unidentified risks can be "known unknown" or "unknown". Known unknown risks are those that are known, but it is unknown how they could affect the project. For example, the probability of some risks occurring, such as changes in material costs and even natural disasters, can be calculated based on historical information. Unknown risks are totally unknown and therefore not possible to prevent or manage. Examples are certain unprecedented events such as terrorist attacks, civil unrest, or natural disasters uncommon to a region. A challenge during the risk identification process is to reduce the presence of unknown risks during the project life cycle. Known-unknown and unknown risks cannot be managed proactively and thus most often are addressed by allocating an acceptable level of general contingency against the project as a whole that is adequate to manage a reasonable level of unknown risk.

Risk identification is an important component in the development of a P3 framework. The focus of P3s is on known risks which can be mitigated by allocation to one of the involved parties as well as by other methods, such as insurance and quality control. The most common risks of highway projects have been listed in Table 3-1. They have been grouped by project phase and are detailed in the following sections.

Risks in the Development Phase

Political Risks

To be successful, P3 projects must be supported by strong political will at all levels of government. This includes support from the legislative and executive branches as well as the general public. A lack of political commitment is one of the critical risks during the project development phase. It can lead potential private partners to withdraw from the project if concerns arise surrounding the certainty of investment terms. Manifestations of political risk include the outright cancellation of projects by the public agency, the inability to reach an agreement between the public and private partners on the project structure, and the failure to appropriate funds necessary for the proposed project.

Cancellation of a project or failure to reach an agreement between the private and public partners due to lack of political commitment can make it more difficult to attract the private sector in future P3 projects that may be proposed by the public agency.

Political risk is heightened if state P3 legislation allows for a veto of the project by a state or local assembly. The uncertainty surrounding final approval of the project and the inclusion of local political pressures in the decision-making process are powerful deterrents to private sector investment.

Table 3-1. Key Types of Project Risks to Public or Private Partners

Phase	Type of Risk
Development phase	• Planning and environmental process • Political will • Regulatory • Site • Permitting • Procurement • Financing
Construction phase	• Engineering and construction • Changes in market conditions
Operation phase	• Traffic • Competing facilities • Operation and maintenance • Appropriation • Financial Default Risk to public agency • Refinancing • Political • Regulatory • Handback

Regulatory Risks

A clear prerequisite to the development of P3 projects is the existence of P3 enabling legislation. Regulatory risk exists when an inadequate P3 framework is in place. State and local P3 legislation must contain certain provisions to ensure that the P3 program can be attractive to the private sector while protecting the public interest. P3 regulations should provide sufficient guidance, striking the right balance between flexibility and certainty. This will encourage private sector interest.

Desirable provisions in P3 legislation include a requirement for clear procurement guidelines and decision criteria, flexible project eligibility criteria, and the ability to revise toll rates over the project's life[2].

Overall, restrictive P3 statutes (e.g., restricting P3s to a pilot program or requiring multiple legislative approvals for a project) are less likely to attract private sector interest than more flexible legislative provisions. Other regulatory restrictions may include limits on the type of procurement that is authorized, limitations on leasing, limitations on use of financing instruments (including mixing public and private funds on a given project), and restrictions on which public agencies are allowed to enter into P3 agreements (e.g., state departments of transportation but not local authorities). Restrictions on the type of projects and "pilot program" provisions are likely to be perceived by private sector entities as indicating a lack of long-term political commitment to P3s.

Site Risks

During the development phase, greenfield or hybrid P3 projects are exposed to a variety of risks related to the project site's ground conditions. Issues can arise with regard to the suitability of the site, including environmental contamination, poor geological conditions, and archeological remains. Community relations can also lead to site risks if there is a significant amount of local hostility toward a project. In these cases, site risk becomes closely tied to political risk, as local opposition to a project can jeopardize its political support.

Community relations issues can also lead to or worsen right-of-way acquisition risk. In some cases, the public agency will take responsibility for the acquisition of the required land, or the land will be federal or state-owned land. Occasionally, however, the private sector entity must acquire land (e.g., Dulles Greenway in Virginia), which allows for the possibility of a real estate-related upside, but also increases the risk to the private sector. The state may still need to use their condemnation rights in extreme cases.

Permitting Risks

The successful development of P3 projects is tied to the ability of the private sector entity to receive the required federal, state, and local permits. Permitting issues stemming from a lack of preparedness or from difficulties caused by the project's design can cause considerable delays and additional costs. As with site-related issues, public agencies and the private sector partner can share the responsibility for permitting to varying degrees.

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[2] Nossaman, "Overview of Key Elements and Sample Provisions State PPP Enabling Legislation for Highway Projects", October 2005, http://www.fhwa.dot.gov/ipd/pdfs/legis_key_elements.pdf (accessed September 10, 2012).

Planning and NEPA Process Risks

The environmental review required under National Environmental Policy Act (NEPA) provisions is a time-consuming and costly effort, and environmental issues raised during the review process can threaten the viability of the project. Project alternatives being considered in the NEPA process should be viable and financeable as a P3 taking into consideration the availability of public funds. NEPA is often a major constraint on a private entity's ability to offer Alternative Technical Concepts (ATCs), since any significant change can invalidate NEPA approvals. Where a project is being considered for procurement as a P3, there are various best practices that can ensure that the NEPA process is conducted in a way that allows efficiency for a future P3, for example by avoiding over-specification of the project at the NEPA stage in a way that would restrict future innovation.

While the role that the private sector can legally play in the NEPA process is severely restricted, the cost of the NEPA review can be shared between public and private partners. In addition to the NEPA requirements, certain states, such as California, have specific environmental requirements. One way to mitigate NEPA risks is for the public sector to have the environmental process near completion before releasing a P3 solicitation.

Procurement Risks

Procurement risk refers to the risk of failed or flawed procurements. This includes fewer proposers than anticipated, affordability threshold exceeded by lowest bid, procurement award successfully challenged, or noncompliant or low-quality bids submitted. Procurement issues can be caused by general market conditions, but they most often stem from flaws in the design of the procurement process or unsuitable project structures/ risk transfer expectations. It is important that public agencies not be constrained in their procurement practices by regulations requiring that they award contracts to the lowest price bidder rather than to the bidder presenting the best value. There are often valid reasons for conducting a lowest-price competition with a quality threshold, and many proposers prefer this arrangement. In best value procurements, technical or financial quality plays a significant role in the award decision. The public owner needs to understand the value associated with the quality factors.[3]

P3 legislation or guidelines often include procurement procedures for P3s that specify evaluation criteria for P3 proposals, including technical, financial and innovation criteria. However, procurement issues can arise from a lack of clarity in response requirements, excessive financial commitment requirements, insufficient protection of design and proprietary information, or a lack of transparency in the selection criteria. The procuring agency's track record with P3s and other procurements also influences bidders' perception of procurement risk. Procurement risk for

[3] See NCHRP Report 561, *Best-Value Procurement Methods for Highway Construction Projects, Transportation Research Board*, 2006.

private entities seeking to bid on a project can be significant since it is very expensive to prepare a proposal.

Financing Risks

Risks associated with financing for P3 projects can result in the inability to reach financial close or lead to default on project debt during the operating period.

Inaccurate or overly optimistic traffic projections and underestimated project costs can lead to the development of pro-forma financials that appear to justify the investment decision, but that do not reflect the project's actual ability to repay debt or to meet equity investors' return requirements. On project cost estimates, both equity investors and commercial lenders will look to achieve realism in the estimates and will subject them to similar stress tests. Lenders may, however, take a more conservative view of traffic volume projections, and their conclusion on the viability of the project might differ from the more aggressive outlook of the private sector entity. This could make financing difficult to obtain on reasonable terms.

Both commercial and public lenders make their decisions based not only on the intrinsic risk of project default, but also on external factors. Transportation projects have high capital costs and long-term revenue streams and are, therefore, generally financed over 20 or 30 years. With the constrained financial markets since 2007, however, banks became reluctant to have repayments outstanding for such lengthy periods of time. Commercial lenders have demanded more stringent terms, including higher minimum debt service coverage ratios and shorter loan life terms, tighter dividend distribution covenants, higher margins, mandatory refinancing and cash sweep provisions, and requirements for multiple reserve accounts (e.g., for debt service, O&M, and capital improvements).

Many P3 projects today achieve a significantly reduced cost of capital through government loan programs, such as the Transportation Infrastructure Finance and Innovation Act (TIFIA) program, to provide long-term subordinate debt. The availability of TIFIA financing depends on the project's eligibility, the amount of budgetary authority available to TIFIA and the successful mitigation of project risks. Financing risk exists even for projects with strong economics due to the limited amount of credit available from private and public sources.

Financing risks can also be related to regulatory risks. For example, if the tax treatment is not clearly outlined by the P3 regulations or the concession agreement, private lenders are likely to be unwilling to accept the risks. This reinforces the importance of transparency and predictability in P3 legislation, policies and guidelines.

Risks in the Construction Phase

Engineering and Construction Risks

Engineering risk encompasses several sub-risks, including design risk, construction cost risk and latent defect risk.

Design risk refers to the potentially negative effects to the project resulting from flaws in the design work. Design flaws can lead to delays and cost increases, as well as environmental and safety issues, both during the construction and during the operations period of a project.

Construction costs are an important risk area for P3 projects as they can be affected by increases in labor and material costs, as well as by delays and the cost of performance bonds. Construction costs are estimated during the design phase and can be locked in through lump-sum turnkey contracts (design-build) which allow for fixed costs and penalties in case of completion delays. Performance bonds and completion guarantees can also be written into the construction contract to further incentivize the construction contractor to complete work on time and to reduce risk, although this practice can result in a higher contract price.

Latent defect risk is a form of risk linked to a project's construction that is present after the completion of construction. It is the risk of flaws in the infrastructure that are not apparent until operation of the facility begins. Most construction contracts make the DB contractor liable for such defects, and they include penalties and damages to compensate the owner and operator against lost revenue caused by the underperformance or lack of availability of the facility. It is only possible to lock the DB contractor into a relatively short warranty of the work following Final Acceptance. Majoe defects arising several years after the DB contractor has finished will not generally be resolved through recourse to warranty provisions within the original DB contract. This is the reason why a P3 DBFOM provides an effective long-term hedge against latent defects in a way that a DB cannot. However, in hybrid greenfield-brownfield projects, where the concessionaire takes responsibility for existing assets, latent defects are a very contentious issue.

It is important to note that construction cost risk is the only risk that is typically transferred under conventional procurement, although not always successfully. Typically under conventional procurement with DBB, the designer cannot take into consideration all of the contractor's construction methods. The design is therefore not optimized to suit a specific contractor's sequencing, methods, equipment and preferences. The DBB process requires the public owner to manage design and construction interfaces, which often results in claims and inefficiencies compared to DB which has a single point of responsibility. The desire to control cost overruns is a key motivator for the public sector. For the private sector, managing construction costs is a key risk, which the concessionaire usually handles by a design-build contract with another private firm.

Change in Market Conditions During the Construction Phase

Once the final investment decision has been made by the public agency and private sector entities and the P3 agreements have been signed, significant costs are incurred for the permitting, financing, design and construction of a project. Although it is possible to lock in engineering costs, other market conditions can change during the construction period and negatively affect the project. Changes in macroeconomic conditions can affect inflation rates, as well as projected material and labor costs. A public agency can protect itself from construction cost increases by requiring the concessionaire to submit a fixed price contract. The private sector entity will normally add an inflation factor into its final bid, which "expires" after a certain time period to protect against changes in market conditions. Alternatively, indexing approaches may be used to address inflationary cost increases.

Risks in the Operation Phase

Traffic Risks

Traffic risk (for toll-based concessions) refers to the risk that over the life of a project actual traffic levels do not reach projected levels. This would negatively affect the project's cash flows and the ability of the concessionaire to repay debt and generate sufficient equity returns. Traffic risk is often the core component of toll-based concessions, and its allocation defines the project and determines the remainder of the contractual arrangements. Traffic risk is present in any revenue generating facility. It is borne either by the public agency (in the case of availability payments) or by the private sector entity (in the case of toll-based or shadow toll-based concessions), or may be shared by both.

Traffic risk can be influenced by several factors, including the quality of the initial traffic projections, changes in the macroeconomic environment, the existence of alternative routes, and the level of user fees. Initial traffic projections are subject to a thorough vetting by lenders. This vetting can include requiring a review of the initial projections by an independent expert, lowering the risks associated with the quality of the projections.

Competing facilities present revenue risk for toll-based P3 projects. Existing or planned competing facilities can be integrated into traffic and revenue projections, and diversion from the proposed toll facility can be modeled. However, calculating the risk of new (i.e., not previously planned) competing facilities built during the operation phase of a P3 project is less straightforward. Some P3 agreements include a non-compete clause whereby the public agency agrees not to grant permits to a competing facility, or to compensate the concessionaire if a new competing facility is constructed that negatively impacts revenue from the existing P3 facility. The burden of proof typically lies on the private party to demonstrate harm. The public sector may identify planned facilities that are exempt from qualifying as "Relief Events" or cause for compensation.

Additional risks in the operations phase include technology risk, toll violation and toll collection enforcement risks, and risks related to toll escalation with policy caps. Positive impacts from facilities built by the public sector must also be taken into account. In Texas, the concession agreements specify that construction of facilities that induce traffic on the P3 facility must also be taken into account and the net effect must be considered.

Regulatory Risks

During the operations phase, relevant federal or state statutes may change, e.g., laws governing High Occupancy Toll (HOT) lanes such as vehicle occupancy requirements for toll-free service or minimum speed requirements. The public and private partners will need to address these risks in the P3 agreement by stating that discriminatory changes in law qualify as "Relief Events."

There are also risks associated with how contract performance standards are interpreted and overseen by the public agency. One risk considered by the private sector is that a new political administration will come in that is hostile to the deal and seek a more stringent interpretation or enforcement of certain standards in order to undermine the private partners' credibility. There are also regular changes to State DOT policies regarding technology, asset management and maintenance practices that the private sector may be expected to conform with.

Operations and Maintenance Risks

Operations and Maintenance (O&M) risk may result from actual physical issues with facilities or by an increase in O&M costs. O&M risk can also translate into loss of revenue if the facility needs to be closed for an extensive overhaul or if its capacity is reduced during maintenance activities.

O&M costs forecasted at the time of the project's development generally include increases in costs based on inflation or other predetermined factors. Costs can, however, increase beyond the anticipated level, e.g., in cases where labor costs increase above expectations.

Insufficient maintenance can lead to a deterioration of the condition of a project and can ultimately lead to closures, which in turn will cause a loss in revenue (either from tolls or from availability payments) and damage the public's perception of the project. Loss of availability due to natural disasters and similar events is, however, generally considered to be caused by *force majeure* events and may be insured, or may be designated as a risk to be shared by the public and private partners.

For hybrid greenfield-brownfield projects, where the concessionaire takes responsibility for existing assets, latent defects represent a significant risk that can raise contentious issues.

Appropriations Risks

Appropriations risk is the risk that the public agency is incapable of meeting its financial obligations to the project because funds for the project fail to be obligated into its budget. Appropriations risk can affect P3 projects where the public agency is expected to make payments, either as lump-sum payments during the construction period or as availability payments during the life of the project. This risk can be caused by political issues (if there is strong local opposition to the project) or by a change in economic conditions affecting public sector revenues.

Financial Default Risks to the Public Agency

Financial default risk is the risk borne by the public entity that the private sector entity will have financial difficulties that will prevent it from performing its duties according to the P3 contract's terms. Unless there are flaws with the project itself, projects for which a private partner is in financial difficulty can generally be sold to another private sector entity or to a government entity, which allows for continuity of operations. An example is the South Bay Expressway P3 project in San Diego, CA, which went into bankruptcy and was sold to the San Diego Association of Governments (SANDAG), a government entity. Normally, a P3 agreement is set up to allow for lender step-in rights prior to the private sector entity's default. The lenders are then able to manage the project while ensuring the public agency is fully involved in the process.

Refinancing Risks

Financing risk remains present during the operating life of a project. Depending on the initial financing terms, P3 projects can be exposed to interest rate risks, especially if the concessionaire has entered into a floating rate loan and have opted not to hedge. Loan agreements can also carry mandatory refinancing provisions; this provision exposes a project to financing risk when it seeks to refinance its existing loan. To maintain similar debt service coverage ratios, and therefore the same level of default risk, private partners must be able to secure a loan of the same amount as the outstanding principal at the time of refinancing for a sufficient loan repayment period and at an equally or more favorable interest rate.

The availability of debt at the time of the mandatory refinancing (associated with "bullet" maturities) cannot be known to the concessionaire at the time of the initial financing, making refinancing risk difficult to estimate accurately. In the past the private entity has benefited from refinancing, though less so recently. Many recent P3 contracts have provisions that require that the private party share any gains from refinancing with the public agency.

Handback Risk or Residual Value Risk

This is the risk that facility conditions are worse than anticipated at the end of the project. Hand back provisions include the terms, conditions, requirements and procedures governing the condition in which a private partner is to deliver an asset to the public sector upon expiration or earlier termination of the P3 agreement, as set forth in the contract. Contracts need to be structured so that there are financial incentives at the end of a contract to encourage the private partner to make the investments necessary to handback the facility to the public agency in suitable condition.

4 Risk Valuation Methods

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 primer);
- to calculate risk adjustments as part of value for money assessments;
- to help determine project contingency amounts; and
- to identify and monitor mitigation actions (i.e., risk management).

For major projects in the U.S., a series of risk workshops is generally conducted to develop a project "risk register," also known as a "risk matrix," which is used to manage risks throughout all phases of the project. An example of a risk register is presented in Table 4-1. The risk register will usually comprise the following components:

- *Risk Category* – type of risk (as discussed in Chapter 3);
- *Risk Topic* – identifying the specific risk;
- *Risk Description* – including a summary of the potential loss if the risk event occurs;
- *Risk Probability* – the likelihood of a risk occurring (e.g., high, moderate, low);
- *Potential Consequence* – impact of the risk, should it occur;
- *Allocation of Risk* –whether the risk will be transferred to the private sector, shared or retained; and
- *Treatment Options* –actions that can reduce the likelihood or consequences of a particular risk (i.e., risk mitigation).

The risk matrix may also include the results of *Risk Valuation* – either a qualitative priority ranking or a quantitative estimate of the potential financial cost or "risk premium" based on the consequence and likelihood of a risk occurrence. This Chapter focuses on risk valuation methods.

Qualitative Risk Analysis

Qualitative risk analysis includes methods for prioritizing the identified risks for further action. It assesses the priority of identified risks using their probability of occurrence, the corresponding impact on project objectives if the risks do occur, as well as other factors, such as the time frame and risk tolerance of the project.

A typical qualitative assessment based on the process used by the Virginia DOT is discussed in this section. Workshop participants are asked to carry out a qualitative risk valuation for each risk using their professional judgment and experience from previous projects. If available, historic data from similar previous projects and details of specific risk events are used to inform the risk assessment.

The valuation is carried out by categorizing risks based on their probability of occurring and cost and schedule impact, as noted below.

Table 4-1. Example of Risk Register

Example 1	
Risk Category	Right of Way (ROW) / Utilities
Risk Topic	ROW Acquisition
Impact Phase	Construction
Risk Description	The project is to be constructed in an area that is developing rapidly so land prices are highly volatile. As a result, the cost of ROW acquisition could be significantly higher than in the current estimate.
Consequence of Risk	Higher prices in future would result in increase in project costs
Ability to Transfer Risk	It may be possible to transfer this risk in a PPTA contract but a high risk premium may be included by Offerors if they feel unable to control or influence the underlying economic drivers. It may be more cost effective for the Agency to accept this risk and try to mitigate it.

Source: Virginia DOT's PPTA Risk Analysis Guidance, September 2011

Probability range: Any risk event that has a probability of occurring of 90% or above would be included in the cost estimate and not on the risk register. One of the following options is selected to define the probability of the risk occurring:

- Greater than 70% (and below 90%)
- 40% to 70%
- 20% to 40%
- 5% to 20%
- 0% to 5%

Cost impact: One of the following options is selected to define the cost impact as a percentage of the baseline project cost estimate:

- Greater than 25%
- 10% to 25%
- 3% to 10%
- 1% to 3%
- Less than 1%

Schedule impact: One of the following options is selected to define the schedule impact in terms of the period of time that the project would be delayed (or expedited) if a particular risk event were to occur:

- Greater than 52 weeks
- 16 to 52 weeks
- 4 to 16 weeks
- 1 week to 4 weeks
- 0 to 1 week

Expected risk impact for cost and schedule are automatically categorized based on Tables 4-2 and 4-3 below. At this stage of assessment, the impact is classified as Very High, High, Medium, Low or Very Low.

The appropriate impact and the color code associated with the risk impact are automatically populated in the risk register once the probability and consequence are selected.

Table 4-2. Qualitative Assessment of Cost Impact of a Risk

			Cost Consequence				
			Greater than 25%	10% to 25%	3% to 10%	1% to 3%	Less than 1%
	Scale		5	4	3	2	1
Probability	Greater than 70%	5	Very High	High	High	Medium	Low
	40% to 70%	4	High	High	Medium	Medium	Low
	20% to 40%	3	High	Medium	Medium	Low	Low
	5% to 20%	2	Medium	Medium	Low	Low	Low
	0% to 5%	1	Low	Low	Low	Low	Very Low

Source: Virginia DOT's PPTA Risk Analysis Guidance, September 2011

Table 4-3. Qualitative Assessment of Schedule Impact of a Risk

			Schedule Consequence				
			Greater than 52 weeks	16 to 52 weeks	4 to 16 weeks	1 to 4 weeks	0 to 1 week
	Scale		5	4	3	2	1
Probability	Greater than 70%	5	Very High	High	High	Medium	Low
	40% to 70%	4	High	High	Medium	Medium	Low
	20% to 40%	3	High	Medium	Medium	Low	Low
	5% to 20%	2	Medium	Medium	Low	Low	Low
	0% to 5%	1	Low	Low	Low	Low	Very Low

Source: Virginia DOT's PPTA Risk Analysis Guidance, September 2011

Quantitative Risk Analysis

Quantitative risk analysis is performed on risks that have been prioritized by the qualitative risk analysis process as potentially and substantially impacting the project. Quantitative risk analysis is conducted to quantify risks in terms of both cost and time impact. Two alternative levels of quantitative risk analysis may be undertaken:

- *Formula-based analysis* using a simple formula to calculate average risk impact using minimum, maximum and most likely cost and schedule impacts;
- *Monte Carlo simulation* using specialized software for Monte Carlo simulation of expected cost and schedule impacts to get a range of aggregate risk values along with their probabilities.

A risk workshop is an effective tool for gaining expert input into the quantification of risk probability and potential impact. Quantitative risk analysis allows an agency to carry out a Value for Money (VfM) assessment during the pre-procurement phase, as well as after bids is received. A quantitative risk analysis may also be helpful in developing key contract terms.

The approaches used by the Virginia DOT for quantitative analysis are discussed in the following sections.

Formula-Based Quantitative Risk Analysis

With this approach, workshop attendees determine specific values for:

- The probability of occurrence (between 5% and 90%).
- A Minimum (Min), Maximum (Max) and Most Likely (ML) cost impact of the risk in terms of dollars.
- A Minimum (Min), Maximum (Max) and Most Likely (ML) schedule impact of the risk in terms of months.

The following formula is used to calculate the risk value of each individual risk:

$$Risk\ Value = Probability\ x\ \ (Min + Max + 4\ x\ ML)/6$$

The formula presumably attempts to replicate very simply the result that might be obtained with more sophisticated analyses using simulation (discussed in the next section). A contingency amount may be added to account for unknown risks.

Many risk events are likely to have an impact on both cost and schedule. Schedule impact is quantified in units of time, but delays also have a cost associated with them. The direct cost impact of risk events are accounted for under the analysis of cost risk but indirect costs from delays are not. Indirect costs from delays include the added interest costs of financing and the cost of running site offices, utilities and the time cost of engineers, inspectors and administration staff. Indirect costs will include agency indirect costs (including independent oversight / construction management) and the contractor's indirect costs. The total cost of delay is the sum of the agency indirect costs and the contractor's indirect costs. Additionally, in the case of tolled facility, there will be a loss of revenue that will also need to be accounted for.

In order to get a complete picture of total potential project cost, the agency can calculate the dollar value of schedule impacts by calculating a "per week" value for indirect costs and multiplying this unit rate by the expected schedule impact / delay associated with the risk event. An average rate may be used for risk events during construction and a second value for risk events during operations. Historic data may be used to verify the amounts.

Sensitivity analysis may be used to evaluate financial outcomes when critical assumptions are changed. This can help decision makers better understand how assumptions shape the expected outcomes of a project and to anticipate the types of conditions that might trigger remedial actions. Sensitivities on key financial and operating conditions may be undertaken through a number of likely scenarios such as low, middle and high cases. This will provide a more accurate reflection of the potential spread of the total cost to the public agency.

Quantitative Risk Analysis Using Monte Carlo Simulation

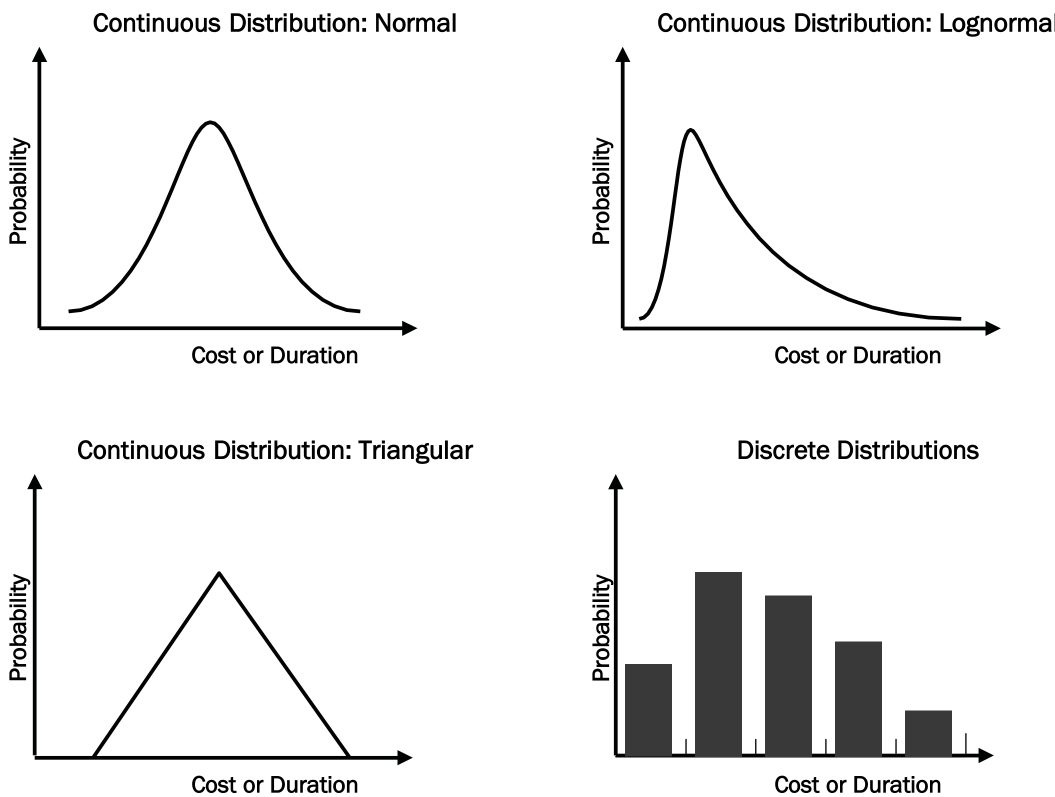
A Monte Carlo simulation (named after the Monte Carlo casino where the uncle of one of the creators of the technique gambled away his money) produces a deterministic sample set of likely project outcomes and the probabilities of their occurrence. The sample set is then used to develop distributions and ranges for aggregate cost and schedule impacts. The simulation provides a range of aggregate risk values that the agency may choose from, depending on what confidence threshold is required. This is not possible with a formula-based analysis.

However, Monte Carlo methods require knowledge and training for their successful implementation. Input to Monte Carlo methods also requires the user to know and specify exact probability distribution information, including mean, standard deviation, and distribution shape. The process is as follows:

1. Quantify probability, cost and schedule impact as per the formula-based analysis described above.
2. Select a distribution type (also known as an assumption curve) according to the nature of the risk being analyzed. Risk modeling software allows the selection of many different assumption curves.
3. Perform a Monte Carlo simulation of cost risk and schedule risk using specialist software such as @RISK or Crystal Ball.

Examples of assumption curves are shown in Figure 4-1. The curves are probability distributions with different mean values and different standard deviation values. All four distributions have a single high point (the mode) and all have a mean value that may or may not equal the mode. Some of the distributions are symmetrical about the mean while others are not. Selecting an appropriate probability distribution is a matter of which distribution is most like the distribution of actual data. For transportation projects, this is a difficult choice because historical data on unit prices, activity durations, and quantity variations are often difficult to obtain. In cases where data is insufficient to completely define a probability distribution, one must rely on a subjective assessment of the needed input variables.

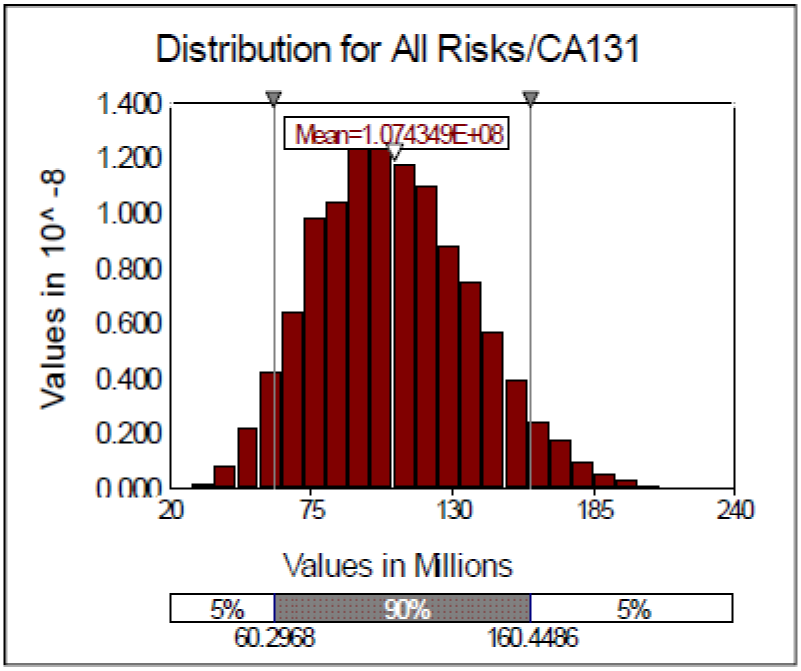
Figure 4-1. Distributions for Risk Analysis



(Source: NCHRP Report 658, *Guidebook on Risk Analysis Tools and Management Practices to Control Transportation Project Costs*, 2010)

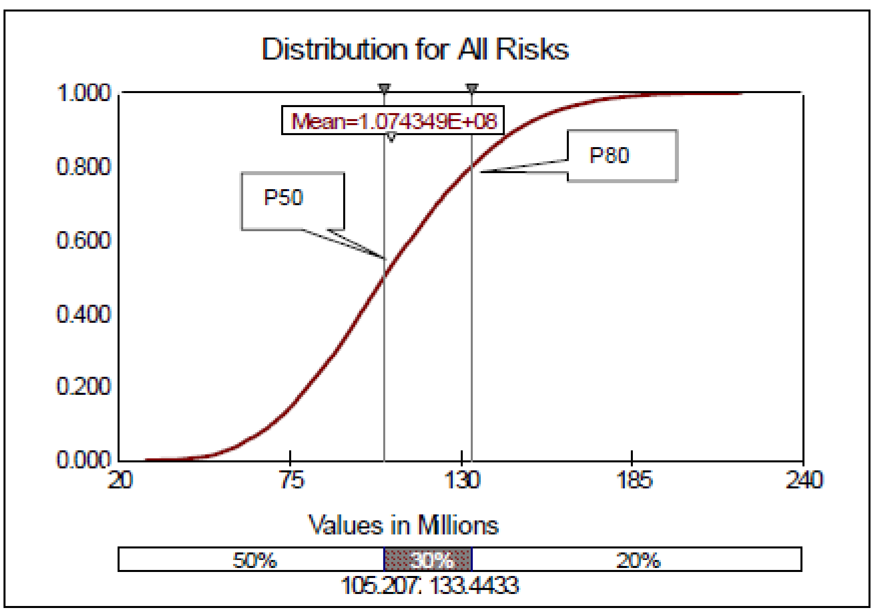
The main output of the simulation is total values for retained, transferred and shared risks. Several types of charts may be generated automatically by the Monte Carlo simulation software. Figures 4-2 and 4-3 present examples of impact distribution graphs. Figure 4-2 displays cumulative risks through the use of a histogram. Figure 4-3 shows an alternative method of displaying cumulative risks through the use of an S-Curve.

Figure 4-2. Risk Distribution Histogram



(Source: Virginia DOT's *PPTA Risk Analysis Guidance*, September 2011)

Figure 4-3. Risk Distribution S-Curve Showing Confidence Levels



(Source: Virginia DOT's *PPTA Risk Analysis Guidance*, September 2011)

The S-Curve allows values to be used based on the confidence level required for the project. In Figure 4-3, the 50th percentile (also known as the P50), mean and 80th percentile (P80) are shown since these are the most commonly reported statistics. The mean represents the average of all generated outputs which is not the same as the P50 unless the distribution is symmetrical. The confidence level selected will depend on the stage of assessment, confidence in cost estimates and complexity of the project. The P80 is widely used by public agencies in risk analysis at earlier stages when project information is less well developed in order to show a confidence level of 80% that risk costs will not exceed the estimated value. It should be noted that the public and private sectors have different preferences with regard to the confidence level. For example, a risk averse public agency may use P90 as its confidence level preference, while private entities may be more comfortable using a P50 confidence level.

5 Risk Allocation Strategies

Risks identified in a risk register (as discussed in Chapter 4) may be categorized in one of three ways:

1. *Transferrable* risks, i.e., risks fully transferrable to the private sector.
2. *Retained* risks, i.e., risks for which the government bears the costs, e.g., the risk of delay in gaining project approvals.
3. *Shared* risks, i.e., risks that are shared based on a combination of the above two allocations due to the nature of the risk.

Risk allocation is at the core of P3s, which are structured around the sharing of risks (and rewards) between the public agency and private sector entity. It is the transfer of risks that provides incentives to the private entity to innovate in the approach it takes to delivering a project under a P3. One study of 17 P3 projects found that risk transfer valuations accounted for 60% of the total forecasted cost savings under a P3 approach.[4] This may be due to the private entity's ability to manage a specific risk more efficiently, or its acceptance of a lower confidence level in the valuation of the risks (as discussed in Chapter 4).

Transferring too little risk to the private sector would constrain the value for money that could be achieved. Conversely, transferring too much risk (e.g., risk that the private sector is unable to manage) will result in high risk premiums, making the project more costly and driving down the value for money.

Projects with P3 agreements lend themselves to a wide range of strategies for allocating risk. This Chapter examines risk allocation strategies most commonly used in managing risk for highway projects.

Risk Allocation Process

Prior to allocating risks between the public and private sectors, the risks must be identified and analyzed, as described in Chapters 4. Although some level of project risk is an objective fact, the public agency and the private sector entity often have different assessments of risk from their dissimilar points of view and priorities. A comparison of differing risk assessments is an important step in achieving the optimal allocation of project risks among parties and achieving maximum value for money. For example, the public sector may have less appetite for financial risk because it is difficult for the public agency to insulate the rest of its budget from the consequences of a default or

[4] Source: Study by Andersen and LSE Enterprises for the Treasury Task Force, UK. *Value for Money Drivers in the Private Finance Initiative.* January 17, 2000.

bankruptcy. P3 partners create special purpose ventures that generally limit the liability of partners to the amount invested.

To determine the optimal allocation of risk, an agency compares the public sector's ability and willingness to manage each risk to the ability and willingness of a potential private partner to do the same. Risks that the private sector is more capable of managing are transferred; risks that the public agency is more capable of managing are retained. Where possible, the party with responsibility for managing the risk will seek to mitigate or avoid that risk. If a risk is difficult to assess or manage, it may be appropriate that it should be shared between the public and private sectors. An effective risk allocation should create incentives for the private sector to supply quality and cost-effective services.

While the concept behind optimal risk allocation is clear, the practice of how agencies allocate risks is more of an art than a science. Typically, the public sector will be expected to take on regulatory risks. Site risks, e.g., utilities, ground conditions or hazmat, may be transferred or shared. The private sector will be expected to take on risks arising from the building, operation, finance, and management of the project. The concessionaire may choose to transfer risks to other private parties by selling equity stakes, holding subcontractors responsible for performance, and/or insuring against certain risks.

Public Sector Standpoint

From the public agency's standpoint, P3 projects are considered to be a means for transferring the project risks to the private sector. However, transferring *all* of the risk to the private sector entity does not necessarily produce the optimal outcome, particularly if there is no potential upside for the private sector entity; in such cases, it will only increase the private sector entity's required return on investment as it will not be able to efficiently manage all of the risk transferred to it. Additionally, the private sector entity may lose interest in the project during the development phase, leading to failed bids. If the private entity does accept excessive risk, it could face financial difficulties during operations, leading to default and potentially to an interruption or decline in service. Risk allocation is better envisioned as the practice of finding an equilibrium point, where the level of risk to be borne by the public agency and the private sector entity is acceptable to both.

P3s are structured based on risk-reward trade-offs. Both the public and the private sectors have tolerance levels for risk and required returns (see Figure 5-1). P3s must contain a balanced risk/reward profile to be considered attractive by the public and private sector.

Private Sector Standpoint

From a private sector entity's standpoint, P3 projects need to adequately balance risks and rewards. In other words, if there is a risk of loss (downside risk), there should be an opportunity for higher gains (upside risk) to compensate. For example, private sector entities will not accept excessive traffic risk if tolls are capped at relatively low levels.

The private sector entity's willingness to accept a particular risk also depends on its ability to manage the risk, the existence of sufficient rewards to compensate for the risk, and the clarity of the contractual dispositions transferring the risk. Private sector entities have a risk/return tolerance level above which their investment decision becomes positive. The shape and position of this risk tolerance (see Figure 5-1) can change over time as the cost of capital and return requirements change.

Optimal Risk Allocation

A successful P3 arrangement allocates risk in an optimal manner that is acceptable to the public agencies and private sector entities alike. Each risk is allocated to the party best suited to manage or mitigate it.

Graphically, the optimal risk allocation can be represented as the area that is within the acceptance level of both parties (see Figure 5-1). This area forms the boundaries for the negotiations of P3 agreements. Public agencies strive to ensure that this optimal allocation is achieved at the lowest possible cost for taxpayers, while private sector entities attempt to maximize their returns within the acceptable boundaries. Under an optimal risk allocation scheme, risks are generally allocated as shown in Table 5-1, which shows how risk allocation differs for DBFOM projects relative to conventional procurement (Design-Bid-Build) and Design-Build. Note that there is a significant level of detail not shown in this table. For example, even though it is a starting point to transfer all permit risk to the private sector under a P3, it is often a more complex risk allocation in practice – the public sector takes on the risk of the initial permits, but the private sector takes on the risk of any permit amendments associated with detailed design.

Figure 5-1. Optimal Risk Allocation in P3 Projects for Both the Public and Private Partners

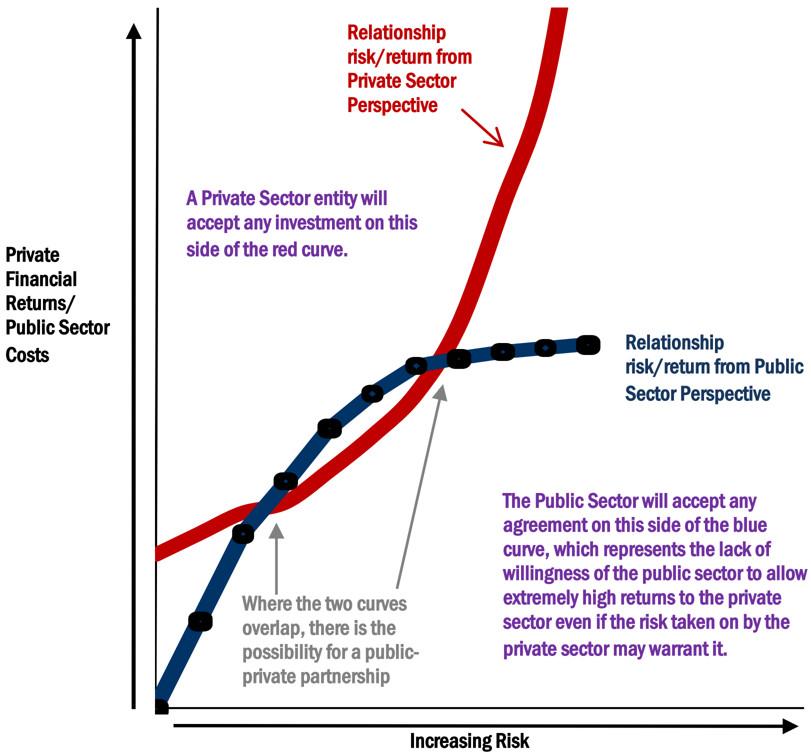


Table 5-1. Common Risk Allocation Under Conventional and P3 Procurement

Risk	Design Bid Build	Design Build	Design Build Finance Operate Maintain
Change in Scope	Public	Public	Public
NEPA Approvals	Public	Public	Public
Permits	Public	Shared	Private
Right of Way	Public	Public	Shared
Utilities	Public	Shared	Shared
Design	Public	Private	Private
Ground Conditions	Public	Public	Private
Hazmat	Public	Public	Shared
Construction	Private	Private	Private
QA / QC	Public	Shared	Private
Security	Public	Public	Shared
Final Acceptance	Public	Private	Private
O&M	Public	Public	Private
Financing	Public	Public	Private
Force Majeure	Public	Shared	Shared

Source: Virginia DOT's *PPTA Risk Analysis Guidance*, September 2011

6 Incorporating Risk into Value for Money Analysis

The Role of Risk Assessment in Evaluating Public-Private Partnerships

Value for Money (VfM) analysis has been used in many countries to help government officials ensure that when entering into a P3 agreement, they are in fact getting a better deal for the government than they would through conventional approaches to procure the same project. Value for Money analysis is utilized to compare the aggregate benefits and the aggregate costs of a P3 project procurement against those of the conventional public procurement alternative. An assessment of project risks is a key input into Value for Money analysis.

Under the conventional design-bid-build procurement process, while contractors assume significant risks such as labor supply and weather risks, public agencies typically retain a significant portion of the risks associated with a project. When public agencies take on major projects under a conventional procurement process they do evaluate risks but budget and schedule estimates are often uncertain. Also, the full life cycle costs of a project are typically not considered.

P3 procurement processes require a transparent accounting and valuing of risks, because the risks transferred to the private sector will generally be factored into the costs of bids as a risk premium. The bid price accounts for risks that the public sector may not normally consider, but must nonetheless be managed. For example, force majeure - a natural event that may significantly damage the project or reduce the number of users – is a risk that will have an impact on the revenues of the project. The private sector proposal will reflect the expected value of that risk, which may be affected by the availability in the market of business interruption insurance, while the pricing for the conventional public sector approach typically does not (although the risk is taken into consideration if bonding of toll revenue is sought by the public sector).

Through a VfM analysis the public sector can understand the totality of a project's costs and make certain risk cost adjustments to get an "apples-to-apples" price comparison of different procurement options. VfM analysis can help answer the question: Is it worth paying a price premium to a private concessionaire to take on certain project risks in return for establishing a reliable fixed cost into the future? The methodology for carrying out a VfM analysis basically involves[5]:

- Creating a Public Sector Comparator (PSC) which estimates the life-cycle cost (including operating costs and costs of risks, which are not typically considered in conventionally procured projects) of procuring the project through the conventional approach, in terms of Net Present Value (NPV);

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[5] See FHWA's *Value for Money Analysis: A Primer*, December 2012

- Estimating the life-cycle cost of the P3 alternative (either as proposed by a private bidder or a hypothetical "Shadow Bid" which attempts to predict the bidder's costs, financing structure and other assumptions at the pre-procurement stage);
- Completing an "apples-to-apples" comparison of the costs of the two approaches.

A Public Sector Comparator (PSC) is first developed as a baseline against which a P3 procurement, either hypothetical or as proposed by a private bidder, will be compared. A favorable comparison, in which the P3 achieves the same outcome for lower overall costs, shows the P3's ability to generate value for money. An unfavorable comparison is evidence that the P3, as imagined or proposed, is unwarranted.

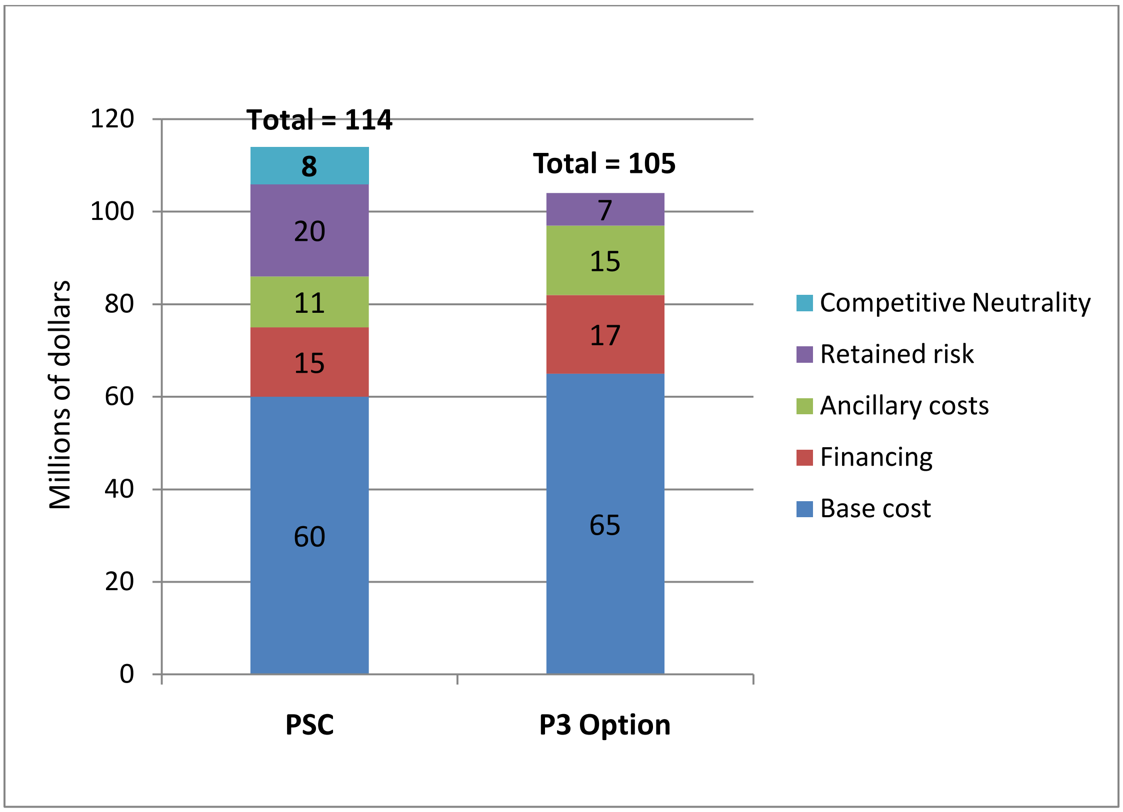
The PSC estimates the hypothetical *risk-adjusted* cost if a project were to be financed, implemented and operated by the public sector. The PSC is generally divided into five elements: the "raw" PSC, financing costs, competitive neutrality, retained risk and transferable risk. The raw PSC includes all capital and operating costs associated with building, owning, maintaining and delivering the service over the pre-determined term of the P3 agreement. "Competitive neutrality" removes any competitive advantages or disadvantages that accrue to a public sector agency such as freedom from taxes and is discussed further below. "Retained risk" refers to the value of any risk that is not transferable to the private sector, and "transferable risk" refers to the value of any risk that is transferable to the private sector.

"Competitive neutrality" removes any competitive advantages and disadvantages that accrue to a public sector agency by virtue of its public ownership, such as freedom from taxes. Taxes are costs that ultimately result in revenues to the public. It might be possible to distinguish among the various levels of government to whom taxes are paid, so that taxes paid to the Federal Government are treated differently from state or local taxes. A similar adjustment is required with respect to insurance. When the government chooses to self-insure, there is a perception that the government has saved on insurance premiums. In fact, the government is taking on risks otherwise covered by insurance, and the government should account for this additional risk. An adjustment is made to the PSC by adding an amount equivalent to the premium otherwise paid by the private sector under a P3 to account for the additional risks. Examples of public sector disadvantages include the additional costs associated with accountability, public scrutiny, and reporting requirements. A private company may sometimes have fewer of these costs in pursuing the same project.

Once established, the PSC's overall cost is used as a benchmark against which the costs and risks to be borne by the government under a P3 agreement are compared. The P3 option is analyzed for its whole-life total cost to the government, including the net present value of the project's direct costs and the value of any retained risks not transferred to the private sector. Generally, as shown in Figure 6-1, a P3 proposal must cost less than the PSC in order to be preferable to a conventional procurement approach.

The example depicted in the bar chart portrays a comparison between a public procurement with a baseline present cost of $60 million and a P3 shadow bid for which the baseline present cost (net of financing costs) is $65 million. While the baseline P3 cost is $5 million more and imposes an additional $6 million in ancillary and financing costs, the $13 million reduction in the costs of risk due to transfer of some risks to the private sector and $8 million in competitive neutrality adjustments overcome these cost differences and result in a net savings to the government of $9 million overall, offering 7% in Value for Money. This example illustrates the central trade-offs that often characterize P3 procurement: the government trades away significant risks in exchange for higher baseline costs and financing costs in the P3 scenario.

Figure 6-1. Comparison of PSC and P3 Availability Payment Concession



Risk Cost Adjustments for Value for Money Analysis

Once risks have been quantified and allocated as discussed in Chapters 4 and 5, their value (i.e., the likely cost of these risks should they occur) needs to be incorporated into the Value for Money (VfM) analysis in order to compare procurement models on a risk-adjusted basis.

VfM Assessment Process

For the VfM Assessment undertaken at the *pre-procurement* stage, the main steps in the analysis are as follows:

1. Develop quantified risk assessments for both PSC and Shadow Bid options. The main difference in costs will be due to risks transferred to the private sector in the Shadow Bid option, under which expected costs of transferred risks will be lower.
2. Sum up the present value of retained, transferred and shared risk costs, allocating costs of shared risks between transferred and retained using a ratio of 50:50 unless specific allocations are available.
3. Apply the total values of retained and transferred risks to the PSC and Shadow Bid base estimates. A range of values may be used in a sensitivity analysis, resulting in a range of VfM results.

After bids are received, if the P3 alternative will be based on an availability payment structure, the preferred proposal may be compared to the PSC. The PSC estimate of costs and revenues will need to be risk-adjusted using updated procurement phase information. If the P3 will be a tolled concession, the preferred proposal may be compared to either the Shadow Bid or the PSC.

Risk Adjustments to the Public Sector Comparator

Since the purpose of the Public Sector Comparator (PSC) is to estimate the cost of a project to the owner if it were procured conventionally, with no transfer of risks to the private sector as under a P3, the expected value of these retained risks must be added to the cost of the PSC.

The incorporation of risk into the PSC can be accomplished in one of two ways:

1. By calculating the aggregated expected value of risk during the development, construction and operational phases, and then discounting them to a net present cost (NPC)[6] to be added to the overall project NPC, as shown in Table 6-1; or
2. By adjusting the annual cash flows in the development, construction and operating periods to appropriately account for the risks, thereby making the project cash flows risk-adjusted, as shown in Table 6-2. When the risk-adjusted cash flows are discounted to calculate the NPC of the project, the resulting NPC will also be risk-adjusted.

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[6] Discounting is explained in FHWA's *Value for Money Analysis: A Primer*.

Table 6-1. Calculating Aggregate Expected Value of Risk

Year	Risk Adjustment	Discount Factor	Discounted Risk value*
1	10	1.000	10.00
2	2	0.9434	1.89
3	3.5	0.8900	3.12
4	0.5	0.8396	0.42
5	0.5	0.7921	0. 40
Total	**16.5**		**15.83**

*Discounted risk value = Risk Adjustment x Discount factor

Adapted from Industry Canada, The Public Sector Comparator: A Canadian Best Practices Guide

Table 6-2. Illustrative Cash Flow Example Including Risk Adjustments

Year	Capital	Operating	Indirect	Disposal	Risk Adjustment	Total	Discount Factor	Discounted Cash flow*
1	100		4		10	114	1.000	114.00
2		20	4		2	26	0.9434	24.52
3	10	20	4		3.5	37.5	0.8900	33.38
4		20	4		0.5	24.5	0.8396	20.57
5		20	4	-50	0.5	-25.5	0.7921	-20.20
Total	**110**	**80**	**20**	**-50**	**16.5**	**176.5**		**172.27**

*Discounted cash flow = Total cost x Discount factor

Adapted from Industry Canada, The Public Sector Comparator: A Canadian Best Practices Guide

Retained risks are quantified, where possible, using the methodologies explained in Chapter 4, with the resulting expected value being equivalent to the government's expected cost of self-insuring them. A contingency fund, reflecting the value of these retained risks, may be included in the financial assessment and in the agency's project budget and funding analysis. The process used to value transferred risks is discussed below.

Calculation of Risk Premium for the Shadow Bid

For VfM assessments undertaken at the *pre-procurement* stage, the Shadow Bid includes the cost of bearing transferred risks in its costs of financing as well as in its contingencies relating to both construction and operating budgets.

An important consideration in the quantification of risk is that the potential financial impact of a risk event is determined from the perspective of the party retaining the risk. A risk that is transferred to a private partner better able to avoid or mitigate that particular risk would have a lower value under the Shadow Bid than under the PSC. For example, in the absence of the discipline imposed by at-risk equity finance under a P3, costs associated with the potential for construction delay risk might be considered more likely (higher) under conventional procurement where the incentives to achieve construction schedule are less significant. Since the most qualified firms will be attracted to the project, they will be best able to manage the risks without adding a large premium.

Risk premium value may be affected by market forces. For example, it would be low if there are few projects relative to the number of contractors looking for work. The analyst team determines the value to be included for the risk premium. This value is added to the Shadow Bid estimate.

If a risk can be insured, the cost to obtain the insurance (i.e., the insurance premiums) is used to value that risk in the Shadow Bid, rather than the expected value of the outcome of the risk if it were to occur. Such insurance typically includes (among others) construction and contractor insurance, third party liability, business interruption, equipment failure, and technology-related risk. The premiums represent the actual cost to the private partner of bearing the underlying transferred risk. In the case of the PSC, the value of these insurance premiums is also used to represent the value of these risks if they are retained by the public sector.

Risks that are not transferred to the private sector are considered retained by government, and represent a cost to the project regardless of the procurement model selected.

7 Summary

Risk is a key characteristic of public private partnerships, influencing project structure and cost, and the assessment of risk is a critical task in developing, negotiating, evaluating and managing P3 projects. Risk assessment assists in overall project evaluation, supports the design of technical requirements and commercial terms prior to procurement, assists in negotiations with proposers with regard to the allocation of risk, and is a pre-requisite in development of risk management plans.

Under the conventional design-bid-build procurement process, public agencies typically retain majority significant portion of the risks associated with a project. When public agencies take on major projects under conventional procurement process they tend to undervalue those retained risks. As a result, budget and schedule estimates are often optimistic and the full life-cycle costs of a project are rarely considered. P3s derive much of their value by structuring contract agreements to transfer many of the risks that are conventionally retained by the public sector to the private sector.

P3 procurement processes require a transparent accounting and valuing of risks, because the risks transferred to the private sector will generally be factored into the costs of bids as a risk premium. To ensure the best value for the public, the procuring agency needs to perform a thorough risk analysis to determine which risks it should manage internally and which ones it should transfer to the private sector.

Risks are identified and assessed through workshops, i.e., formal meetings where project team members, subject matter experts and others responsible for estimating the costs and schedule of a project work together to identify and analyze risks. Risk workshops result in a "risk register" describing significant risks, assessments of risk probability and impact, and preliminary risk response plans.

Agencies may use the risk register to assign a monetary value to each risk. This can help a public agency decide which risks to transfer to the private sector, which to retain, and which to share. By calculating the net present value of the risks transferred to the private sector under a P3 procurement model, a public agency can compare the risk-adjusted net present cost (NPC) of procuring the project under the conventional procurement method to that of a P3 procurement in order to assess value for money. A key criticism of risk valuation pertains to the validity of the calculations. A sensitivity analysis to test the effect of key assumptions is therefore essential.

The goal of a P3 is not to transfer all project risks—rather, it is to transfer those risks that the private sector can manage most efficiently and that meet the overall goal of the project. For each risk transferred, there is a premium that the project owner must pay to the private entity. A risk may be priced differently by the public and the private sector, depending on their capabilities. It may be financially inefficient to transfer risks that the private sector will have a difficult time managing.

Appendix A: Glossary

Term	Description
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. Government normally contracts with only one lead party (bidder) who is responsible for the provision of all contracted services on behalf of the consortium.
Contingency	An allowance included in the estimated cost of a project to cover unforeseen circumstances.
Concessionaire	Private entity that assumes ownership and/or operations of a given public asset (e.g., train station, bus operation) under the terms of a contract with the public sector
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, operations, and maintenance responsibilities of the asset.
DBB	Design-Bid-Build: Under a DBB, the private sector delivers a design and bids for a project in two separate processes. Once the private sector has been awarded the contract, it assumes responsibility of project construction (build).
DBFOM	Design-Build-Finance-Operate-Maintain: Under a DBFO or a 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.
Discount rate	The discount rate is 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.
Leveraging	Leveraging is the degree to which an investor or business is utilizing borrowed money.
OIPD	Office of Innovative Program Delivery: The OIPD is a part of the FHWA that provides tools and expertise regarding P3 approaches.
Opportunity risks	A risk may be categorized as an opportunity risk if it has the potential to have a positive impact on the project. Opportunity risks are intrinsic to the project. If an agency quantifies risks differently for different procurement structures, the potential for double-counting efficiencies that are provided through the risk allocation for a procurement structure (as part of the VfM Analysis process) can exist.
Non-technical risk	Risks posed by political, regulatory, economic, and social conditions, or stakeholders.
NPV	Net present value.
PAB	Private Activity Bonds are a new type of financing that provides private developers and operators with access to the tax-exempt bond market, lowering the cost of capital significantly.
PSC	Public Sector Comparator: A 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 transferable 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 a government proposes to bear under a P3 arrangement.
RFP	Request for Proposals.
RFQ	Request for Qualifications.
Risk allocation	The process of assigning operational and financial responsibility for specific risks to parties involved in the provision of services under a P3. Also see risk transfer.

Term	Description
Risk Allocation Matrix	A table used as a management tool throughout the procurement process to provide an overview of the major risk categories to be considered when developing procurement, to explain why the risks are transferred, shared, or retained under different procurement options. As each deal will have project-specific risk, the Risk Allocation Matrix is only a tool to help understand the principles regarding risk allocation. For each project, the actual risk allocation will need to consider the principles of allocation and the circumstances of the deal.
Risk Register	A document which identifies the bearer of a particular risk and which will also contain quantitative assessments (i.e. costs and likelihoods) of the characteristics of the risks).
Risk transfer	The process of moving the responsibility for the financial consequences of a risk from the public to the private sector.
SPV	Special Purpose Vehicle: An SPV is a legal entity comprised of multiple shareholders created for a specific project to reduce risk exposure of its individual members and to protect the project from unrelated liabilities of its individual members. In a typical P3, an SPV is created to bid on a project and to obtain project financing.
Technical risk	Risks arising from deviations from the project's original technical assumptions, specifications, or requirements.
TIFIA	Transportation Infrastructure Finance and Innovation Act: The TIFIA program provides Federal credit assistance in the form of direct loans, loan guarantees, and standby lines of credit to finance surface transportation projects, such as P3s, of national and regional significance.
Transferrable risk	The value of any risk that is transferable 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 project objectives.[7]

[7] Office of Transportation Public-Private Partnerships, *PPTA Value for Money Guidance*