

P3-Value: Shadow Bid Tool User Manual

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Table of Contents

1	Overview	1-1
	Purpose of P3-VALUE.....	1-1
	Structure of P3-VALUE.....	1-2
	Accompanying Evaluation Resources.....	1-3
	Shadow Bid Tool	1-4
	System Requirements	1-4
2	Quick-Start Guide	2-1
3	Shadow Bid Development Overviews	3-1
	Timing.....	3-1
	Developing a P3 Estimate.....	3-1
	Using the Shadow Bid Tool.....	3-2
4	Key Assumptions	4-1
	Traffic Scenarios.....	4-3
	Project Delivery Structure.....	4-3
	Timing.....	4-4
	Entering Cost Assumptions	4-5
	Construction Costs.....	4-5
	Operating and Maintenance Costs	4-5
	Other Project Costs (Concessionaire Costs).....	4-6
	Toll & Other Revenue.....	4-6
	Funding.....	4-7
	Project Financing	4-7
	Inflation	4-9
	Discount Rate	4-10
	Selecting the Discount Rate.....	4-10
	VfM Assumptions	4-12
	Depreciation.....	4-13
	Risk Allocation & Risk Values.....	4-14
	Other Project Costs (For Agency)	4-17
	Funding for Agency Costs	4-17
5	Cash Flow Sheets	5-1
6	Outputs	6-1
	Availability Payment Analysis	6-1
	Toll Scenario Analysis.....	6-2
	Real Toll Scenario Analysis	6-2
	Shadow Toll Scenario Analysis.....	6-4
	Project IRR Analysis	6-4
	NPC Results	6-5
	Sensitivity Analysis.....	6-7
	Scenario Analysis.....	6-8
	Financial Statement	6-10
	Incorporating Outputs with other P3 VALUE Tools.....	6-12
7	Summary and Tool Limitations	7-7-1
	Shadow Bid Tool Limitations.....	7-7-1



Appendix A: Qualitative Assessment Issues Checklist

Appendix B: Glossary

Appendix C: References

Tables

TABLE 1: INTEGRATING RISK ASSESSMENT OUTPUTS WITH THE SHADOW BID TOOL.....4-16

Figures

FIGURE 1: P3-VALUE OVERVIEW..... 1-3
FIGURE 2: KEY COMPONENTS OF THE SHADOW BID TOOL..... 3-3
FIGURE 3: VFM ANALYSIS - AVAILABILITY PAYMENT..... 6-2
FIGURE 4: REAL TOLL VFM SCENARIO ANALYSIS 6-3
FIGURE 5: SHADOW TOLL VFM SCENARIO ANALYSIS..... 6-4
FIGURE 6: VFM PROJECT IRR ANALYSIS 6-5
FIGURE 7: NPC RESULTS OUTPUTS CHART..... 6-6
FIGURE 8: NPC RESULTS BAR GRAPH 6-7
FIGURE 9: SENSITIVITY ANALYSIS OUTPUT..... 6-7
FIGURE 10: SCENARIO ANALYSIS..... 6-9

1 Overview

The Federal Highway Administration’s (FHWA) Office of Innovative Program Delivery (OIPD) is producing a P3 Toolkit comprising tools and guidance documents to assist in educating public sector policymakers, legislative and executive staff and transportation professionals. The P3 Toolkit forms the base of a broader P3 capacity-building program which includes a curriculum of P3 courses and webinars. The P3 Toolkit will address Federal requirements related to P3s and four key phases in P3 implementation: (1) Legislation and Policy; (2) Planning and Evaluation; (3) Procurement; and (4) Monitoring and Oversight.

The target audiences for the P3 Toolkit resources are decisionmakers and technical staff in public sector agencies such as:

- ▶ State Executive and Legislative Offices;
- ▶ State Departments of Transportation (DOT);
- ▶ Metropolitan Planning Organizations (MPOs);
- ▶ Regional Planning Agencies;
- ▶ Tolling Authorities;
- ▶ Local jurisdictions; and
- ▶ FHWA Division Offices.

Purpose of P3-VALUE

P3-VALUE (Public-Private Partnership Value-for-Money Analysis for Learning and Understanding Evaluation) is a key component of FHWA’s P3 Toolkit. It is a suite of educational tools that introduces users to public-private partnerships (P3s) and the methods used in P3 evaluation, discusses limitations, and explains how public agencies may evaluate different procurement options for a particular project. P3-VALUE can help users understand the processes and considerations that go into a rigorous quantitative analysis of P3 procurement options for transportation projects. P3-VALUE is based on the experience of the U.S. P3 market and therefore reflects the terminology and methodology practiced in the United States. The focus of FHWA’s Office of Innovative Program Delivery and its P3-VALUE tools is on long-term P3 contracts that involve designing, operating, constructing, operating and maintaining new highway facilities, also known as greenfield projects.

P3-VALUE is based in Microsoft Excel, and is supported by primers, user guides and other guidebooks, some of which are under development. Practitioners can use P3-VALUE to better understand the concepts, inputs, assumptions and outputs from evaluations of risk, financial feasibility and “value for money” analyses, which are used to evaluate the potential of P3s to



generate value in comparison with conventional methods of project delivery. Users are cautioned that P3-VALUE has been designed for educational purposes only and is not intended to guide decisions on actual projects. The complexity of the analyses for specific projects requires that they be performed by experts using more detailed modeling; however, P3-VALUE provides hands-on instruction in how such detailed modeling analyses are conducted, and can help government officials understand the importance of the inputs and assumptions used by modeling experts, and the extent to which key assumptions can affect the analysis results.

Structure of P3-VALUE

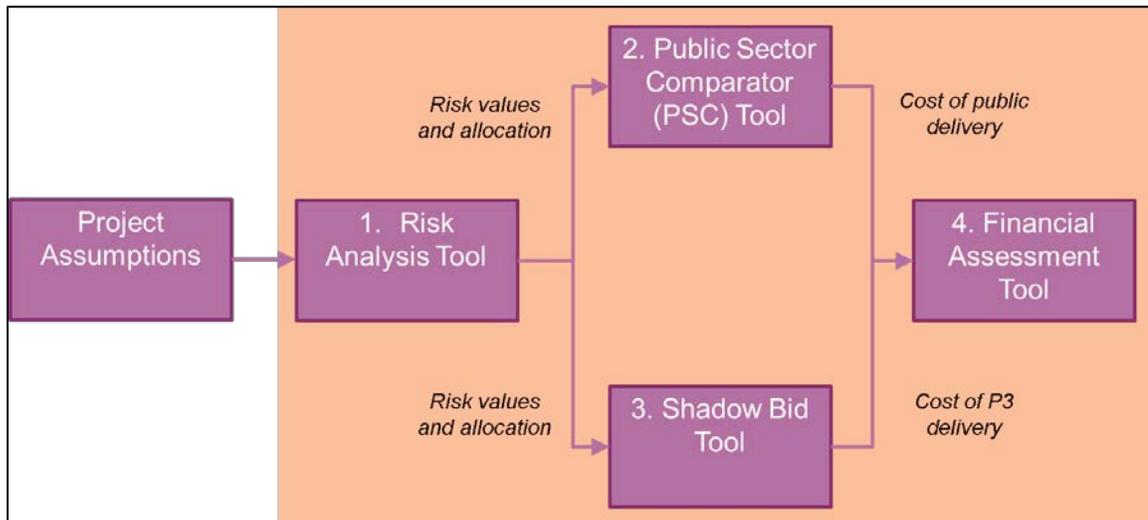
Under a public-private partnership (P3) for a highway project, a private partner may participate in some combination of design, construction, financing, operations and maintenance, including collection of toll revenues. Value for Money (VfM) analysis is a process used to compare the financial impacts of a P3 project against those for the traditional public delivery alternative. The methodology for carrying out a VfM analysis that is incorporated in P3-VALUE involves:

- ▶ Creating a Public Sector Comparator which estimates the risk-adjusted whole-life cost of carrying out the project through a traditional approach;
- ▶ Estimating the risk-adjusted whole-life cost of the P3 alternative (either as proposed by a private bidder, or a hypothetical “shadow bid” at the pre-procurement stage); and
- ▶ Completing an “apples-to-apples” comparison of the present values of costs under the two approaches.

As depicted in Figure 1, P3-VALUE is comprised of four interactive, integrated spreadsheet-based analytical tools that allow users to explore different components of Value for Money Analysis (VfM) including:

- ▶ **Risk Assessment Tool** – This tool allows users to document project risks and risk management strategies and to estimate the costs of risks under different procurement structures.
- ▶ **Public Sector Comparator (PSC) Tool** – This tool allows users to calculate the risk-adjusted costs for a project that is designed, financed, constructed, maintained and operated under a traditional public sector delivery model.
- ▶ **Shadow Bid Tool** – This tool allows users to calculate the costs of payments to a private partner for delivering a project as a P3 concession.
- ▶ **Financial Assessment Tool** – This tool allows users to compare the PSC and Shadow Bid costs for procuring a project and to assess the financial subsidies required using different procurement methods.

Figure 1: P3-VALUE Overview



Accompanying Evaluation Resources

P3-VALUE is supported by several other tools and guides, including:

- ▶ An *Orientation Guide* that summarizes the issues and factors that are evaluated when considering a P3 as a financing and procurement mechanism;
- ▶ Three Primers, one each on *Risk Assessment* (reference for Risk Assessment Tool), *Value for Money Analysis* (reference for Public Sector Comparator and Shadow Bid tools) and *Financial Structuring and Assessment* (reference for Financial Assessment Tool);
- ▶ *User guides* for each analytical tool in the P3-VALUE suite that explain how to use the tools;
- ▶ *Frequently Asked Questions* and a *Troubleshooting Guide* that provide technical advice in support of the P3-VALUE tools;
- ▶ *Evaluation Guidebooks* (under development) for practitioners seeking a deeper understanding of evaluation processes and data sources as well as the concepts, assumptions, inputs and outputs involved in the above analyses; and
- ▶ *P3-SCREEN*, an Excel-based project screening tool along with a supporting user guide to assist practitioners seeking to perform a preliminary screening evaluation of the suitability of a P3 for high-cost highway projects.

P3-VALUE and its accompanying evaluation resources serve as a reference for decision-makers and practitioners seeking to understand P3s as a financing alternative for major capital projects. Practitioners can use P3-VALUE and its accompanying resources to familiarize themselves with the process of evaluating procurement decisions, the data required to conduct quantitative assessments



of procurement options and the impact that various assumptions can have on the desirability and feasibility of different procurement structures.

Shadow Bid Tool

This User Manual, the *Shadow Bid Tool User Manual* (User Manual) dated April 19, 2013, corresponds to version 1.0 of the *Shadow Bid Tool*, and both are part of FHWA's P3-VALUE tool suite. The Shadow Bid Tool demonstrates the analysis required to develop a P3 Estimate, also known as a "Shadow Bid Estimate," which is an estimate of a private sector bid price for a project. A P3 Estimate can be compared with a Public Sector Comparator to evaluate whether delivering a project through a P3 or through standard delivery method is likely to provide greater "value for money" for the public sector.

FHWA designed the Shadow Bid Tool and User Manual as educational materials to demonstrate how a public agency may develop a P3 Estimate and apply it to a VfM analysis. Although the Shadow Bid Tool is interactive, FHWA does *not* intend for users to conduct a VfM analysis for a "real-world" project using the tool. FHWA expects that appropriate experts will perform such an analysis for a project sponsor. Project data assumptions and requirements vary by project, thereby necessitating project-specific VfM evaluation procedures.

FHWA's *Primer on Value for Money Assessment for Public-Private Partnerships (Primer)* provides an overview of basic PSC and VfM concepts and is accessible at www.fhwa.dot.gov/ipd/p3/toolkit/guidance_documents/vfm_for_ppps/toc.htm. The *Guidebook for Value for Money Analysis for Public-Private Partnerships*, which is currently under development, will build upon the Primer to provide an advanced understanding of the practical applications and challenges of conducting a Value for Money Analysis.

System Requirements

The P3-VALUE tools are Microsoft Excel spreadsheets that are best viewed in Microsoft Excel 2007 or later editions. Users may not be able to access the tools when using an earlier version of Excel or when using a different operating system, such as Macintosh.

2 Quick-Start Guide

While the User Manual provides detailed guidance on the Shadow Bid Tool, users may also refer to the “Quick-Start” version below for step-by-step instructions.

ACCESSING THE SHADOW BID TOOL

1. OPEN THE SHADOW BID TOOL.
2. CLICK “ENABLE EDITING” AND/OR “ENABLE CONTENT” ON THE YELLOW BAR ACROSS TOP OF SCREEN.
3. READ THE DISCLAIMER AND CLICK “I ACCEPT.”

MANAGING INPUT FIELDS

1. NAVIGATE TO THE “ASSUMPTIONS” SHEET.

This sheet contains project data that provides the basis for constructing a P3 Estimate.

INPUT DATA IN THE LIGHT BLUE CELLS.

- a. Define the project.
 - i. Select a scenario from the “Traffic Scenario” drop-down menu.
Note: See the blue sheets, including “Simple Toll Example” and “Variable Toll Example” for pre-populated toll rate and traffic volume assumptions and “Toll Scenario Template” for a blank toll calculation sheet.
 - ii. Check all the applicable boxes under “Project Delivery Structure” to reflect the project/scenario.
Note: Depending on what boxes are selected, irrelevant assumptions cells may turn from light blue to black.
 - iii. Complete the “Timing” table with appropriate dates in ‘YYYY’ format or in number of years.
- b. Estimate project costs.
Note: Enter costs in base year dollars (*not* current or year of expenditure dollars), consistent with the base year defined in step a) above.
 - i. Itemize “Design & Construction Costs” by asset in the relevant table. Input the “Asset Type” (in Column D), cost in dollars (in Column E), and a breakdown of the expenditure across the design and construction phase (up to 10 years) as a percentage.
Note: The “Year” columns will turn from light gray to blue as values are input. The “Check Sum” value (Column P) should equal 100 percent once the costs are allocated to year of expenditure.
 - ii. Input operations and maintenance costs in the “Operating Costs” table as either a percentage of construction costs (in Column E) or as a dollar figure (in Column F).
Note: If users choose to input O&M costs as dollar values, the adjacent cells in Column E black out so that the inputs are only either dollar values or percentages.
- c. Estimate project funding, financing, and revenue.



- i. Enter assumptions regarding toll revenue leakage (percentage), revenue ramp-up assumptions, and value of additional revenues (in dollars) in the “Toll & Other Revenue” table.
- ii. Enter funding resources as either a percent of construction cost (Column E) or dollar value (Column F) and allocate across the spending period (up to 10 years) in the “Funding” table.
Note: The “Check Sum” value (Column Q) should equal 100 percent.
- iii. Input the percent of project to be financed after taking into account other funding.
- iv. Enter additional financing information in the “Financing” table.
- v. Input the level of equity return (as a percentage).
- d. Apply appropriate adjustments.
 - i. Input inflation assumptions as percentages in the “Inflation” table.
 - ii. Manually input the discount rate as a percentage in the “Discount Rate” table or select “Project IRR” as the input type.
Note: When manually inputting data, the discount rate reflected will be nominal, not real, unless users assume no inflation. Selecting “Project IRR” will reflect the project internal rate of return as the discount rate.
 - iii. Assess potential efficiencies that the private sector may generate under a P3 delivery structure and enter those cost, schedule, and O&M efficiencies as percentages.
 - iv. Input the Federal and State tax rates (percentages) that apply to the concessionaire.
 - v. Enter the period (number of months) of working capital and indicate if a tax carry forward is to be applied by selecting from the drop-down menu.
 - vi. Enter data about each asset’s depreciation, including selecting either the straight line or highway accelerated method, inputting the length of the asset’s life and residual value, and either expensing or capitalizing the debt interest and fees during the construction period.
- e. Additional cost inputs.
 - i. Use outputs from the Risk Assessment Tool to input the risk allocations and values of cost and schedule impacts in the “Risk Allocation” and “Risk Values” tables.
Note: Refer to the FHWA Risk Assessment Tool and corresponding *Risk Assessment Tool User Manual* for information on obtaining appropriate outputs.
 - ii. Input additional agency costs, such as for planning and development, into the “Other Project Costs” table as dollars (in Column E) and select appropriate start and end dates from the drop-down menus.
 - iii. Input “Funding for Agency Costs” as a percentage if the agency has a grant specifically to cover its costs.

OUTPUTS

1. NAVIGATE TO THE “SHADOW BID DISCLAIMER” SHEET.
2. READ THE DISCLAIMER AND CLICK “I ACCEPT.”
3. NAVIGATE TO THE “VFM OUTPUTS” SHEET.

This sheet displays the results in tabular and graphic formats as well as provides several analyses.

4. **SELECT “AVAILABILITY PAYMENT” FROM THE LIGHT BLUE CELL (B22) IN THE “AVAILABILITY PAYMENT ANALYSIS” BOX AND CLICK THE “PAYMENT CALCULATION” BUTTON TO RUN THE ANALYSIS.**
 - a) Payment Scenario Analysis can be run using a real toll or shadow toll delivery structure.
Note: It will be necessary to update the “Assumptions” sheet to include toll collection for the Payment Scenario Analysis to run.
5. **CLICK “CALCULATE IRR” AND REVIEW THE RESULT.**
Note: This step is only necessary if the users select “Project IRR” for the discount rate on the “Assumptions” sheet.
6. **REVIEW THE RESULTS IN THE NET PRESENT COST (NPC) TABLE.**
 - a) Note the values in the final row, which represent the value of P3 delivery to the agency.
7. **SELECT A PERCENTILE AND VALUE (\$ OR %) FOR THE SENSITIVITY ANALYSIS AND CLICK “RUN SENSITIVITY.”**
8. **ADJUST ASSUMPTIONS IN THE “PROJECT SCENARIO ANALYSIS” TABLE USING THE ARROWS.**
Note: If users change key assumptions, the message “Please Solve Again” will appear in the “VfM Analysis” or “VfM Scenario Analysis” box to update the payment information.
9. **NAVIGATE TO THE “FINANCIAL STATEMENT” SHEET AND SELECT A RISK PERCENTILE FROM THE LIGHT BLUE CELL (F4).**
 - a. Observe differences in the value of assets, liabilities and equity incurred, net income, etc. Click “Optimize Dividend” at the bottom-left of the sheet to recalculate the after-tax cash flow.

3 Shadow Bid Development Overviews

Timing

A public agency that is considering delivering a project as a P3 may choose to conduct a VfM analysis to identify the comparative value that different delivery structures may provide. The key stages of a VfM analysis are:

1. **Conduct a risk assessment** to identify, quantify, and allocate risks between the public and private partners.
2. **Develop a PSC estimate** that indicates the potential cost of public delivery.
3. **Develop a P3 estimate** (or “shadow bid”) that indicates the potential cost of private delivery.
4. **Conduct a VfM analysis** that compares the PSC and P3 Estimate (or “shadow bid”) outcomes to assess whether the public or P3 delivery option provides greater value for money to the public agency.

Developing a P3 Estimate

The User Manual focuses on the development of the P3 estimate, or “shadow bid.” The key components that comprise a P3 Estimate are discussed below.

- ▶ **P3 Contract Payment** reflects an amount that the public agency may pay to the private sector P3 partner to make private investment in the project financially viable. Under the P3 contract, the private sector incurs the costs of delivering the project as well as associated financing costs and equity returns. These costs are considered when calculating that P3 contract payment. If the private sector P3 partner receives revenues from tolls and other sources in the arrangement, the revenues that it receives are subtracted from the costs it incurs to indicate the net revenue or payment required for it to invest in and to deliver the project. If the project revenues are sufficient to cover the costs incurred by the private sector in delivering the project and an acceptable equity return, then it may not be necessary for the agency to provide a P3 Contract Payment. (In fact, the concessionaire would be willing to pay the public partner for the right to keep surplus toll revenue.)
- ▶ **Retained Risks** reflect the construction and operation phase risks that the public agency would remain responsible for under the P3 delivery structure.
- ▶ **Other Project Costs** can include costs such as right-of-way (ROW) acquisition costs, procurement costs, and other costs incurred by the public agency in facilitating project delivery.

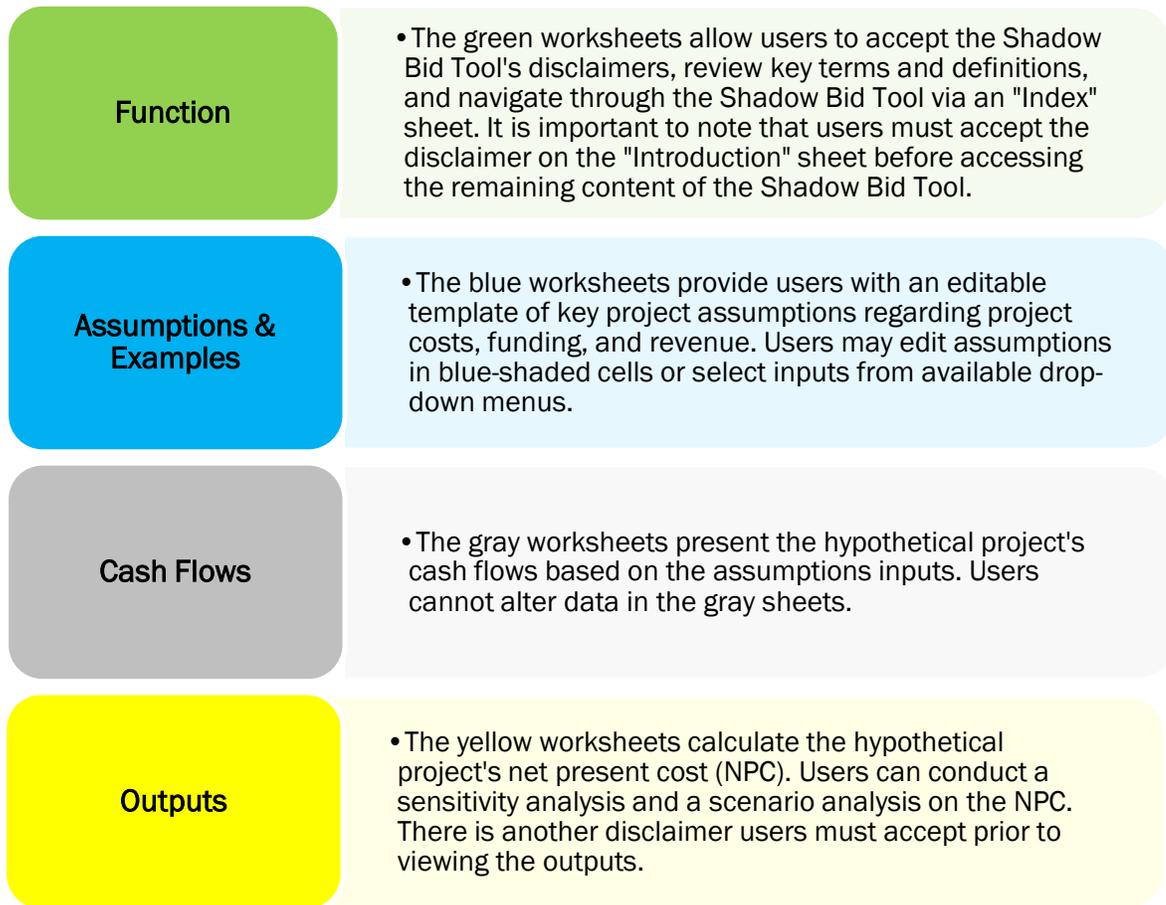


Public agencies may take different approaches to prepare a PSC and P3 Estimate. They can:

1. Develop the PSC and P3 Estimate using unique assumptions for each delivery structure;
2. Utilize the same project assumptions (such as construction length, construction costs, operation and maintenance costs, revenues, risks) for the PSC and the P3 Estimate and make adjustments to the P3 Estimate to reflect the private sector's likely approach to delivering the project; or
3. Utilize the same project assumptions for both the PSC and the P3 Estimate and adjust the P3 Estimate for the cost of private financing to account for the difference in costs between a publicly financed project and a privately financed project. A qualitative assessment is then conducted to consider the potential for the private sector to generate the level of savings or efficiencies necessary to overcome the differences in financing costs and to meet public sector goals for the project. Appendix A contains an example checklist for estimating qualitative factors for a VfM analysis and Chapter 8 of the *Primer* provides additional guidance on qualitative VfM assessments.

Using the Shadow Bid Tool

As outlined in Figure 2, the Shadow Bid Tool contains four major classes of worksheets that are color-coded by purpose. It is important to note that although the PSC and Shadow Bid Tools in the P3-VALUE Toolkit generally adopt the same structure, there are variations in the worksheets and outputs to reflect the different delivery options. Therefore, it is essential that users refer to the appropriate manual for each respective tool.

Figure 2: Key Components of the Shadow Bid Tool

4 Key Assumptions

The Shadow Bid Tool’s pre-loaded example scenario represents a hypothetical highway project to demonstrate the types of inputs that users need to develop a P3 Estimate as well as to demonstrate how the P3 Estimate outputs inform the VfM analysis.



Developing the key assumptions for the PSC and P3 Estimate is a complex process that brings together the outcomes of several other tasks conducted in a project's development. Depending on the project, assumptions may include:

- ▶ Project schedule;
- ▶ Cost estimates for design, construction, operation, and maintenance;
- ▶ Cost estimates for other projects costs such as land/ROW;
- ▶ Tolling, traffic and revenue analysis;
- ▶ Public policy decisions regarding the project objectives and tolling;
- ▶ Funding analysis (estimates of grants or subsidies available for the project);
- ▶ Financial analysis (estimates of the capital structure - debt and equity - and associated costs and terms of private finance, such as the coupon or interest rates, fees, maturity, and grace period for the P3 Estimate) and a detailed financial plan;
- ▶ Inflation analysis; and
- ▶ Outcomes of the risk assessment

In evaluating a “real-world” project, public agencies would have to conduct extensive analyses and investigations to obtain these inputs. Agencies would likely refer to previous project examples to assess how the project assumptions were developed and then assess how the actual project was procured and delivered. Agencies would also engage market specialists and project leaders regarding lessons learned from previous projects and determine ways to improve assumptions based on how those projects were delivered.

The “Assumptions” sheet provides the data inputs for the P3 Estimate. To calculate the cost of P3 delivery to the public agency, the Shadow Bid Tool estimates how much it will cost the private sector to deliver the project over the entire life cycle. Therefore, the Shadow Bid Tool assumptions consider a range of project costs and/or revenues that the private sector incurs or receives in



delivering the project. The Shadow Bid Tool assumptions also consider costs incurred by the agency, such as the cost of rights-of-way (ROW) and risks that the agency will manage under the P3 delivery structure.

It is important to note that the assumptions relating to the private sector's costs and revenues reflect the private sector's view of the project. For each assumption category, the assumptions may be the same as the PSC or they may be different if the agency has determined that the private sector may deliver the project differently. For example, the assumption for maintenance cost may be different in the P3 Estimate if the agency anticipates that the private sector can achieve long-term maintenance cost efficiencies. When common assumptions vary between the PSC and the P3 Estimate, it is important for the agency to recognize that the VfM analysis outcome is based on the premise that the private sector can bid the project and deliver it as estimated to realize the anticipated VfM.

Using the Shadow Bid Tool

Users input key project data into the "Assumptions" sheet. Note that all inputs are entered into the cells shaded light blue either manually or from the available drop-down menus. The assumptions fields represent the types of inputs users would need to develop a P3 Estimate, though actual assumption categories and values for a "real world project" would be project-specific. The general categories of assumptions included in the Shadow Bid Tool are:

- Traffic Scenarios
- Project Delivery Structure
- Timing
- Design & Construction Costs
- Operating & Maintenance Costs
- Other Project Costs
- Toll & Other Revenue
- Funding and Financing
- Inflation and Discount Rates
- VfM Assumptions
- Depreciation
- Outcomes of the risk assessment

Traffic Scenarios

The “Example Scenario” demonstrates a range of assumptions that may be considered when preparing a P3 Estimate.

If tolling is part of the P3 delivery structure, then a traffic scenario may be developed to reflect the private sector’s view on traffic. The Shadow Bid Tool provides tolling examples that can be loaded into the Shadow Bid Tool to demonstrate analysis for a tolled highway project, which can be selected from the “Traffic Scenarios” drop-down menu. If the “Toll Scenario Template” is selected, users can navigate to the “Toll Scenario Template” sheet and enter data in this sheet. The template accommodates variations in toll rates and vehicle classifications similar to the “Variable Tolling Example” and the “Simple Tolling Example” scenarios.

The project and traffic data provided in the example scenario in the Shadow Bid Tool is for general information purposes only. When an agency is conducting a VfM analysis for a specific project, the assumptions used in constructing the P3 Estimate, such as the traffic and revenue assumptions, will reflect the specific project being analyzed.

Project Delivery Structure

The example projects stored in the Shadow Bid Tool demonstrate different project delivery structures. Users can alter the delivery structure of an example project through the “Project Delivery Structure” check boxes. The components of the project delivery structure options in the Shadow Bid Tool are:

- ▶ **Design Build:** The design aspect refers to completing plans for the project, which includes producing engineering drawings and selecting construction materials and the construction site. Build refers to constructing the facility, 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. Design Build is generally carried out by the private sector in P3 delivery structures.
- ▶ **Finance:** Financing includes providing capital for the project, which may include issuing debt such as project revenue bond, and raising equity. This option is also generally checked for a P3 delivery structure. Other assumptions, such as those relating to tax and depreciation, may also be needed in the Shadow Bid Tool if private finance is included in the P3 delivery method.
- ▶ **Operations:** Operations includes facilitating the performance and availability of the highway, which includes removing debris and snow. It may also include the cost of collecting traffic data. This option can be checked in the Shadow Bid Tool if the P3 contract includes operations in its delivery structure.
- ▶ **Maintenance:** Maintenance 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. This option can be checked in the Shadow Bid Tool if the private sector will undertake highway maintenance as part of the P3 delivery structure.

- ▶ **Toll Collection:** Toll collection includes the installation and operation of toll collection facilities if the agency is seeking to include toll revenues under the P3 delivery structure, such as a Real Toll P3 delivery structure. This option can be checked in the Shadow Bid Tool if the P3 delivery structure involves tolling.

Timing

The “Timing” assumptions develop the project cash flows and define when specific costs and inflation factors apply to the project. The project delivery structure selected in the Shadow Bid Tool (which may include Finance, Operation, Maintenance, etc. listed above) will determine which “Timing” assumptions will apply for the project. For example, if toll collection is not included in the project delivery structure, then the “Timing” assumptions for tolling, including length of tolling period and start and end dates, are not visible. Users will input data manually for the following “Timing” assumptions:

- ▶ Base Date (date - format YYYY)
- ▶ Construction Period (number of years from 1 to 10)
- ▶ Construction Start (date - format YYYY)
- ▶ Operations Period (number of years from 1 to 75)
- ▶ Operations Start (date - format YYYY)

Based on the inputs to the above “Timing” assumptions, the following fields will be calculated:

- ▶ **Concession Period (no. years)** – Sum of the construction period and the operations period
- ▶ **Construction End (date)** – Adds the construction period to the construction start
- ▶ **Operations End (date)** – Adds the operations period to the operations start
- ▶ **Tolling Period (no. years)** – Equals the operations period
- ▶ **Tolling Start (date)** – Equals the operations start date
- ▶ **Tolling End (date)** – Adds the tolling period to the tolling start

The “Timing” assumptions are used to support the project delivery structure selected in the Shadow Bid Tool. For example, a Design-Build-Finance delivery structure can be shown by selecting the ‘Design,’ ‘Build,’ and ‘Finance’ check boxes. The timing assumptions and other assumptions fields that relate to the selected structure, such as Concession Period, Operations Start and Financing, can then be completed.

Entering Cost Assumptions

Users should estimate their cost assumptions in base year dollars (*not* current or year of expenditure dollars) consistent with the base date defined in the “Timing” assumptions table. All costs are inflated based on the user’s assumptions entered in the “Inflation” table.

Construction Costs

The “Construction Costs” assumptions reflect the costs associated with the project's design and construction phases. This may be the cost of a Design Build contract. These costs are provided in the “Asset Type” column. The design and construction costs are typically estimated as part of the project cost estimation process, and the outputs from this process are used as inputs in developing the P3 Estimate. The assumptions for the P3 Estimate may be the same as for the PSC or they may be different if the agency is developing separate assumptions for private sector delivery. The design and construction cost assumptions can be profiled over the construction period (a timing assumption) by allocating the cost percentage per year. This profile includes an “S-curve” for the project that indicates the value of work completed over time and is generated during the cost estimation process. The Shadow Bid Tool provides an example where the costs are designated by asset type. Users may also use the space provided to enter the costs of design and construction activities.

Operating and Maintenance Costs

VfM analysis considers the whole life cycle costs of a project and P3 delivery structures typically include the private sector accepting some responsibilities during the highway operations phase. Depending on the P3 delivery structure, operating costs, routine maintenance costs and/or periodic maintenance cost assumptions may be entered in the “Operating Costs” and “Maintenance Costs” sections of the “Assumptions” sheet to reflect the costs incurred by the private sector in delivering these services to the project.¹ The assumptions for the P3 Estimate may be the same as for the PSC or they may be different if the agency is developing separate assumptions for private sector delivery. Typically, maintenance costs include:

- ▶ **Routine maintenance** that is planned and performed on a routine basis to maintain and preserve the condition of the highway system; and
- ▶ **Periodic (or preventive) maintenance** that includes resealing, re-gravelling, or new line markings at regular intervals during operations.

In the Shadow Bid Tool, the operations and routine maintenance costs are provided as annual costs, and can be entered as either a percentage of construction (Column E), or as a dollar value (Column

¹ Refer to Appendix B for a definition of these costs.



F). The assumptions required for periodic maintenance costs are the same; however users can enter a value in the “Years Per Period” field to indicate how often the periodic maintenance is completed. For example, if the value of the “Years Per Period” field is “8,” then the “Periodic Maintenance Costs” will occur every eight years during the operations phase. Note that if a user chooses to input costs as dollar values, the adjacent cells in Column E black out so that the inputs are only either dollar values or percentages. The Shadow Bid Tool will prompt users to first “zero out” the percentage if switching to dollar values, or vice versa.

Other Project Costs (Concessionaire Costs)

“Other Project Costs” reflect costs that the private sector may incur in delivering the project, such as development fees. The Shadow Bid Tool allows users to enter the “Total Cost” (in dollars) for the “Other Project Cost” assumptions. The total cost can be entered and the “Start Date (Year)” and “End Date (Year)” for each assumption can be populated via the drop-down menu. These costs are funded from the private entity's cash flows, similar to operations and maintenance costs. Therefore they reduce the amount of funds available to be paid out as dividends, requiring a higher payment for the private entity to deliver the project and meet its financing commitments.

Toll & Other Revenue

When considering a toll-based project, public agencies should conduct traffic and revenue (T&R) studies to investigate options for tolling and other revenue that may be generated by the project, prior to conducting a VfM analysis. An agency's decision to proceed with a toll-based concession typically reflects public policy considerations related to the project objectives and is informed by the T&R studies prior to the VfM analysis being conducted. The outcomes from the T&R studies provide the basis for the tolling and revenue assumptions included in the P3 Estimate.

As part of the T&R studies, an agency may develop a set of tolling assumptions (e.g., traffic, toll rates, revenue leakage) for a privately operated facility that are different from the tolling assumptions for a publicly operated facility. This can result in an agency applying different toll assumptions in the P3 Estimate from those used for the PSC. The Shadow Bid Tool demonstrates the following assumptions for a tolled project:

- ▶ A “Simple Toll Example” and “Variable Toll Example” that can be loaded into the Shadow Bid Tool using the “Traffic Scenario” drop-down menu. A blank “Toll Scenario Template” is also provided for users interested in entering their own tolling assumptions. The “Toll Scenario Template” requires the same level of detail regarding toll rates and volumes as the other tolling examples.
- ▶ The “Toll Revenue Leakage” assumption reflects a set percentage of revenue that is not collected each year (i.e., due to unpaid toll violations). “Toll Revenue Leakage” is expressed as

- a percentage deducted from annual gross revenues and is entered as a negative value in the Shadow Bid Tool.
- ▶ The “Toll Revenue Ramp-Up” period reflects the period after the road opens when initial traffic volumes increase to a steady state. The ramp-up period may be up to six years long in the Shadow Bid Tool. Users can enter a negative percentage value for each year to be subtracted from the period's gross toll revenue. It is important to review the traffic assumptions to be used in the P3 Estimate to assess if the ramp-up period has already been factored into the traffic volumes. If so, leaving the ramp-up period assumptions out will avoid double counting the impact of the ramp-up period. Similarly, if toll revenue values are inputs to the P3 Estimate, it is important to consider whether toll leakage has already been accounted for in these values prior to including this assumption in the P3 Estimate.
 - ▶ “Annual Non-Road Pricing Revenue” covers a wide landscape of strategies that may be employed to generate value from the project, which may also be relevant in constructing the P3 Estimate. Depending on the project, non-road pricing strategies may involve the sharing of costs, revenues or financial risk between public and private partners, or may impose fees or taxes on defined groups expected to benefit from the project.² For example, value capture strategies can be applied to roads to take advantage of the increased property values and other economic benefits produced by such improvements as in the case of the San Joaquin Toll Road in California and E-470 in Colorado. Non-road pricing strategies can be accounted for as project revenues under the P3 Estimate.

Funding

The “Funding” assumptions reflect the amount of any grant or subsidy that the agency may receive for a project. In the Shadow Bid Tool, the funding amount reduces the overall construction cost that the private sector will incur in delivering the project. The assumption can be provided as an amount of total funding or it can be set as a percentage of the construction costs.

Project Financing

“Project Financing” assumptions reflect the project's financing plan for the private sector, after the project funding has been taken into consideration. If “Finance” has been checked as part of the P3 delivery structure, then this section of the Shadow Bid Tool needs to be completed. The financing structure provided for the hypothetical project example presents a simple debt and equity

² FHWA, Innovative Program Delivery, http://www.fhwa.dot.gov/ipd/revenue/non_pricing/defined/



structure, with the debt and equity assumptions reflecting averages from recent P3 highway transactions completed in the United States.³

The first assumption is the project's leverage, representing the amount that the project costs are financed through debt. For example, if this assumption is 88 percent in the "Example Scenario", then 88 percent of the project costs (net of Funding) are financed through debt, with the remaining 12 percent financed through equity for the hypothetical project example. Once the leverage is established, assumptions regarding the project's debt and equity sources are required.

The debt assumptions are crucial in understanding the financing costs of a privately financed project. The Shadow Bid Tool provides a simplified project financing example and contains the following example assumptions that may be useful when developing a P3 Estimate:

- ▶ **Facility Start Date** - Calculated as the construction start date in the Shadow Bid Tool (the debt is issued at the start of construction).
- ▶ **Maturity (years)** - Indicates the debt period.
- ▶ **Issuance Fee** - The issuance fee and interest rate determine the financing costs in the Shadow Bid Tool. The issuance fee is a one-time fee incurred when debt is initially drawn and is applied to the total borrowed amount.
- ▶ **Interest Rate** - The interest rate is applied per period to the current loan balance.
- ▶ **Annual Debt Service Cover Ratio (DSCR)** - The minimum required DSCR (see *Primers*) for each cash flow period. The DSCR is calculated after construction completion to ensure that it meets the minimum required DSCR.
- ▶ **Payment Schedule** - Either semi-annual or annual debt payments can be selected from a drop-down menu.
- ▶ **Debt Facility** - The P3-VALUE tools provide for bond- and draw-type facilities. The bond facility is based on the borrower raising debt in the year construction commences, with interest payments throughout the construction phase followed by principal and interest payments during operations until the debt matures. The draw facility is based on the borrower drawing down the debt throughout the construction phase with principal and interest payments occurring during operations until maturity.
- ▶ **Grace Period (no. of cash flow periods)** - Applies to the debt principal payments that commence after construction completion.

The Shadow Bid Tool also includes an "Equity Return" assumption, which is entered as a percentage, which reflects the cost of equity to the project and is the internal rate of return (IRR) to the equity investor. The level of equity is determined by the leverage assumption. The equity

³ Averages are based on publicly available information for the Midtown Tunnel, I-595 Corridor Improvements, Port of Miami Tunnel, North Tarrant Expressway, IH-635 and Presidio Parkway projects.

return is an important assumption in the Shadow Bid Tool, as the payment required by the private sector is estimated to achieve this level of return.

The Shadow Bid Tool provides for two reserves as part of the notional financing structure:

- ▶ **Debt Reserve:** The debt service requirement for each period is based the debt payments calculated for the two future cash flow periods and the DSCR assumption. For example, if the DSCR assumption is 1.5, the requirement equals 1.5 times the sum of the debt payments in two future cash flow periods. The Shadow Bid Tool calculates whether the cash flow available for debt service is sufficient to meet this requirement. If it is insufficient, additional funds are borrowed in the debt reserve account notionally presented on the "Financing" sheet of the Shadow Bid Tool, to increase the funds available for debt service. Any borrowed funds are held in the reserve until they are no longer required to meet the DSCR requirement.
- ▶ **Periodic Maintenance Reserve:** Periodic maintenance can be a high cost item during operations, occurring at regular intervals. To smooth out the cost of periodic maintenance during the operations phase and to provide available funds when periodic maintenance occurs, the Shadow Bid Tool calculates a value per period for periodic maintenance and provides a reserve for these funds, which is notionally presented as part of the "Financial Statement" sheet.

It should be noted that P3 projects typically rely on multiple sources and types of financing over the life of a project. The simple financing assumptions in the Shadow Bid Tool provide a demonstration of the basic considerations that go into calculating a privately financed project's financing costs and are not intended to represent a "real-world" P3 project's financial structure.

Inflation

Cost assumptions are entered into the Shadow Bid Tool in base year dollars and inflated based on user assumptions. There are four inflation factors provided as assumptions in the Shadow Bid Tool and users may input inflation assumptions as percentages for the following indices:

- ▶ Consumer Price Index (CPI) - Applies to all costs during the operations period as well as any non-road pricing revenue).
- ▶ An index for construction phase costs - Applies to construction costs if the field has a value greater than zero.
- ▶ An index for operations phase costs - Applies to operations period costs if the field is greater than zero. (If the value is zero, the CPI will be used).
- ▶ An index for toll rates (if the project delivery structure includes toll collection) – Applies to Toll Rates Revenue.



Discount Rate

The “Discount Rate” in the Shadow Bid Tool is the factor applied to the cash flows to generate the project's Net Present Value (NPV) or Net Present Cost (NPC). With a DCF analysis, all cash flows are discounted to their present value using the discount rate established by the public agency. The discount rate is the rate at which the cash flows occurring at different times in the future are brought to a base period.

The discount rate can either be a manual input or reflect the project internal rate of return (IRR). Agencies may use the P3 Estimate IRR to reflect the time value of money, any risk premium associated with a project, and prevailing market conditions.⁴ The project IRR is generated by a button on the “Output” Sheet, which must be run (after all other project assumptions have been included in the Shadow Bid Tool) for the project IRR to be calculated and used in deriving the NPC results. The project IRR notionally illustrated in the Shadow Bid Tool reflects the risk-adjusted project cash flows at the 70th percentile and is used as the discount rate for all risk-adjusted cash flows. There is a strong link between the level of risks included in the project cash flows and the discount rate selected for the P3 Estimate, as the discount rate can also be used to reflect the risks associated with project delivery. However, the P3-VALUE tools do not allow the user to vary the discount rate based on the level of risk (i.e., P10, P70 or P90), so caution should be used when interpreting the NPV and NPC results.

The same discount rate may be used to calculate the NPV in the PSC and P3 Estimate to provide consistency across the present value calculations. To use the project IRR as the discount rate for the PSC, the user must first calculate the project IRR in the Shadow Bid Tool and then enter the project IRR as the discount rate in the PSC Tool.

A discounted cash flow analysis may utilize either a real or nominal discount rate. The selection of a nominal or real discount rate should be consistent with the use of nominal or real project cash flows. The pre-populated “Example Scenario” in the Shadow Bid Tool includes inflation assumptions that are applied to the project cash flows. The Example Scenario’s nominal discount rate accounts for the effect of inflation and is therefore consistent with the cash flows being discounted. If users wish to apply a real discount rate, then they should assume no inflation factors.

Selecting the Discount Rate

Selection of the discount rate is a critical decision in conducting a VfM analysis because the discount rate affects all cash flows and has a significant influence on the relative NPV. A higher rate will typically favor the P3 Estimate over the PSC and a lower rate will favor the PSC over the P3 Estimate.⁵ This may occur if a larger portion of PSC payments are made in earlier years relative to

⁴ Partnerships British Columbia, *Methodology for Quantitative Procurement Options Analysis Discussion Paper*

⁵ Treasury Board of Canada Secretariat, *Guideline to Implementing Budget 2011 Direction on Public-Private Partnerships*

the P3 Estimate. If payment profiles are similar between the PSC and the P3 option, the discount rate should not affect the relative comparison (i.e., the per cent difference), although the actual values of the PSC and P3 Estimate will change.

Jurisdictions in the United States have adopted various approaches to calculate the discount rate for the P3 Estimate. Following examples set forth by recent United States projects and other jurisdictions, users can select the preferred method for their project. Options for selecting the discount rate are discussed below and users may also reference Chapter 3 of the *Primer* and the *Guidebook for Value for Money Analysis for Public-Private Partnerships* (under development) for additional information on selecting an appropriate discount rate. Methodologies for selecting the discount rate include:

- ▶ **Social Time Preference Rate:** This rate reflects the value society places on consumption of goods and services now, compared with consumption in the future. Refer to HM Treasury in the UK⁶ for further discussion.
- ▶ **Weighted Average Cost of Capital:** This approach applies standard investment portfolio theory by setting the discount rate at the project's pre-tax, time-weighted average cost of capital (WACC) of the P3 delivery structure. This approach incorporates the financing principle that the cost of obtaining finance is separate from the cost of using finance, risk is inherent in a particular asset, and investors in the marketplace are the best estimators of risk value. To accurately model the project over the concession life, the time weighted cost of capital is used and will be equivalent to the project's internal rate of return (IRR).⁷ Refer to Partnerships British Columbia for further guidance.
- ▶ **Capital Asset Pricing Model (CAPM):** The approach applies different discount rates to the PSC and P3 delivery structure, utilizing the CAPM for P3 delivery to account for systematic or market risks within the project cash flows. Refer to Infrastructure Australia for further guidance.⁸
- ▶ **Risk-Free Rate:** The approach uses the public sector's long-term cost of financing as a proxy for a risk-free rate and may be used if the agency believes the costs of project risks are fully reflected in the project cash flows. Examples include FDOT's I-595 Value for Money Analysis.⁹

Consideration of various discount rate methods may be useful in understanding how the selection of the discount rate impacts the VfM analysis results and to highlight the breakeven point between the

⁶ HM Treasury, *Value for Money Guidance*, 2006

⁷ Partnerships British Columbia, *Methodology for Quantitative Procurement Options Analysis Discussion Paper*

⁸ See Infrastructure Australia, *Discount Rate Methodology Guidance*, 2009.

⁹ Florida Department of Transportation, *I-595 Value for Money Analysis*



delivery options.¹⁰ This can be completed through a scenario analysis, based on the discount rates calculated under the various methodologies.

Several discount rate methodologies incorporate an adjustment to the discount rate for project risks. In selecting the discount rate, it is important to review the project's risk register and consider whether any double-counting of risks may occur if the discount rate includes a risk adjustment.

Agencies that choose to use the risk-free rate as the discount rate should understand that the risk-free rate of public sector borrowing reflects the credit worthiness of the public agency rather than the project's specific risk and that to fully account for project risks all potential project risk costs must be quantified through the risk assessment process and applied to project cash flows.

Many project risks are difficult to assess and to quantify through a risk assessment process. To account for uncertainty about project costs and risk values, a project-specific discount rate, such as the project's WACC, may be utilized. Theoretically, a project's WACC reflects the project's cost of capital which is, in turn, a reflection of project investors' time value of money and perception of a project's risk. This is because investors in a project will demand a higher rate or return for a project that is perceived as riskier. In this way, the WACC discount rate methodology may be more indicative of a specific project's risk profile than other approaches.

VfM Assumptions

As stated earlier, there are several different approaches that an agency may take in preparing a P3 Estimate. One approach may result in the agency assessing the potential efficiencies that the private sector may generate under the P3 delivery structure. The efficiencies can be reflected in the P3 Estimate by updating the "VfM Efficiencies Options" project assumptions and preparing tolling assumptions for a P3 delivery structure and running the P3 Estimate with these assumptions. Another option may be to apply a general level of efficiency to the project costs and/or revenues. The Shadow Bid Tool provides examples of the types of general efficiencies that may be applied in a P3 Estimate, including:

- ▶ A construction cost efficiency that reduces the overall project construction cost.
- ▶ A schedule efficiency which reduces the length of the construction and extends the operating period so that the total concession period remains the same. As a result, additional operations and routine maintenance costs can occur when this efficiency is applied.
- ▶ An operating efficiency that reduces the operating costs.
- ▶ A maintenance efficiency that reduces the routine and periodic maintenance costs.

¹⁰ Caltrans, *Analysis of Delivery Options for the Presidio Parkway Project*, 2010

Agencies may also consider an efficiency that reduces the risk values incorporated in the project cash flows, or a revenue efficiency that may increase toll revenues and/or decrease leakage rates or the ramp-up period. In determining which efficiency factors, if any, may be included in a P3 Estimate, it is important for the agency to understand the assumptions that underpin the P3 Estimate's project costs and revenues and how any assumptions regarding private sector efficiencies are reflected in the project cash flows. For example, the risk values provided in the "Example Scenario" are based on an assumption that risks can generally be managed better under a P3 delivery structure. Including an efficiency factor in the Shadow Bid Tool that reduces the baseline costs in the P3 Estimate may result in this assumption being double counted.

The "VfM Tax Options" reflect assumptions on the corporate income tax payable at the Federal and State level. Users may input these assumptions as a percentage, which are used to calculate the notional net income provided on the "Financial Statements." Taxes such as sales tax are generally reflected in the project cost assumptions. However, if an agency considers it appropriate, an estimated PSC adjustment can be applied to the PSC to account for any benefit attributable to the tax-exempt status of the public agency. The corporate income tax rates may also be reduced or set to zero as demonstrated in the "Example Scenario" in the Shadow Bid Tool.

The "VfM Other Options" reflect assumptions that may be required in developing the project cash flows for the P3 Estimate. The Shadow Bid Tool includes an assumption regarding "Working Capital" as an example of the other types of assumptions that may be required for a P3 Estimate. Users are able to select the "Period (No. of Months)" as 6 or 12 months for the "Working Capital" assumption. The "Working Capital" assumption in the Shadow Bid Tool helps to ensure that sufficient cash is retained for the project before dividends are paid.

Additionally, users are able to select "Yes" or "No" from a drop-down menu for the "Tax Carryforward Allowed" assumption. Loss Carryforward is an accounting technique that applies the current year's net operating losses to future years' profits to reduce tax liability. If "Yes" is selected as the assumption, the Shadow Bid Tool applies operating losses to years with positive net operating incomes.

Depreciation

There are a number of factors that influence the tax obligations for the private sector, including the P3 project delivery structure and the concession length. These factors can drive the private sector to structure a project in a specific way that will impact its tax obligations. These include the depreciation rate applied to the project's assets and the treatment of interest and fees on its debt facilities, as in the Shadow Bid Tool.

When developing a P3 Estimate for a real-world project, agencies would seek professional advice on the likely tax and depreciation treatment for their project. In the Shadow Bid Tool, there are



three options to notionally demonstrate the impact of depreciation, which can be selected from the drop-down menu under the "Depreciation" section of the "Assumptions" sheet:

- ▶ "Straight-line" depreciation where an equal amount of depreciation expense is taken annually over the life of the asset. This is the simplest method and is found by taking the original cost of the asset minus the residual value and dividing it by the estimated useful life of the asset.
- ▶ "Accelerated" depreciation where a depreciation expense is taken that is higher than the annual straight-line amount in the early years and lower in later years. It should be noted that there may be statutory restrictions that limit the ability of the private entity to benefit from utilizing this method of depreciation.
- ▶ "No Depreciation" removes the impact of depreciation from the project cash flows.

After the depreciation method is selected, users are required to enter values for the "Asset Life" and "Residual Value." These assumptions are required to calculate the depreciation amounts notionally illustrated in the Shadow Bid Tool. The discussion above indicates that the asset life and residual value are used in calculating both straight-line and accelerated depreciation in the Shadow Bid Tool.

The Shadow Bid Tool also notionally illustrates the impact of how interest paid on project debt can be accounted for by the private entity. Two choices are offered in the tool, which can be selected using the "Interest Expense Treatment" drop-down menu:

- ▶ "Capitalized" interest is an account created on the income statement that holds a suitable amount of funds to pay off upcoming interest payments. Furthermore, this type of interest is seen as an asset and unlike most conventional types of interest, it also is expensed over time.
- ▶ "Expensed" interest is the expense paid for borrowed money. The difference between the two choices impacts the net income or loss for the private entity, which is provided on the "Financial Statements." If applied, capitalized interest may increase net income losses early in a project when compared to interest expensed, reducing the private entity's taxation obligations.

Risk Allocation & Risk Values

Conducting a risk assessment is a prerequisite for developing a P3 Estimate. For general guidance on the risk assessment process, see FHWA's *Primer on Risk Assessment for Public-Private Partnerships* and for step-by-step instructions for conducting a risk assessment, see the *Risk Assessment Tool User Manual* in conjunction with FHWA's Risk Assessment Tool.

The "Risk Allocation" and "Risk Values" tables reflect the outcomes of the risk assessment process. The assumptions for the P3 Estimate may be the same as the PSC or they may be different if the agency is developing separate assumptions for private sector delivery. The assumptions provided in the Shadow Bid Tool include:

- ▶ An allocation of project risks between the public and private sectors based on the preferred P3 delivery structure.
- ▶ The cost and schedule delays calculated as part of the quantitative risk assessment for the project's construction phase and operations phase, including the 10th percentile, 70th percentile, and 90th percentile values for cost and schedule delays in real dollars.

Table 1 below specifies the Risk Assessment Tool outputs that users should carry over into the PSC Tool after completing the risk register from the public sector perspective.

The allocation of transferrable risks is used in the Shadow Bid Tool to calculate the private sector's cost of delivering the project. Another approach to adjusting the private sector's project cash flows to account for the risks they accept would be to include a risk premium in the P3 Estimate rather than the transferrable risk values. The Shadow Bid Tool does not accommodate this approach, but users may refer to the VDOT PPTA Value for Money guidance for additional information on how this approach would apply in a "real-world" project analysis. There is a strong link between the level of risks included in the project cash flows and the discount rate selected for the P3 Estimate, as the discount rate can also be used to reflect the risks associated with project delivery.

The retained risk values in the Shadow Bid Tool represent the risks that the public sector will manage under the P3 delivery structure, which are also included in the P3 Estimate as agency costs. The "Example Scenario" in the Shadow Bid Tool includes risk values that are 15 percent lower than the PSC Tool, which reflects an assumption that the project risks can be better managed under the P3 delivery structure and is based on recent VfM analysis reports for highways.¹¹

¹¹ California Department of Transportation (Caltrans), *Analysis of Delivery Options for the Presidio Parkway Project, 2010* and Florida Department of Transportation, *I-595 Value for Money Analysis*

**Table 1: Integrating Risk Assessment Outputs with the Shadow Bid Tool**

OUTPUTS			INPUTS		
Risk Assessment Tool			Shadow Bid Tool		
<i>Worksheet</i>	<i>Field</i>	<i>Cell</i>	<i>Worksheet</i>	<i>Field</i>	<i>Cell</i>
Table 5 – Cost Impact Outputs	Public % of Cost Risk (DB)	G16	Assumption	DB Phase % Public Cost Allocation	E103
Table 5 – Cost Impact Outputs	Private % of Cost Risk (DB)	H16	Assumption	DB Phase % Private Cost Allocation	E104
Table 5 – Cost Impact Outputs	Public % of Cost Risk (Oper.)	G17	Assumption	Oper. Phase % Public Cost Allocation	E105
Table 5 – Cost Impact Outputs	Private % of Cost Risk (Oper.)	H17	Assumption	Oper. Phase % Private Cost Allocation	E106
Table 5 – Cost Impact Outputs	P10 DB Subtotal	F26	Assumption	P10 DB Cost Impact	E109
Table 5 – Cost Impact Outputs	P70 DB Subtotal	G26	Assumption	P70 DB Cost Impact	F109
Table 5 – Cost Impact Outputs	P90 DB Subtotal	H26	Assumption	P90 DB Cost Impact	G109
Table 5 – Cost Impact Outputs	P10 Oper. Subtotal	F27	Assumption	P10 Oper. Cost Impact	E110
Table 5 – Cost Impact Outputs	P70 Oper. Subtotal	G27	Assumption	P70 Oper. Cost Impact	F110
Table 5 – Cost Impact Outputs	P90 Oper. Subtotal	H27	Assumption	P90 Oper. Cost Impact	G110
Table 7 – Schedule Impact Output	Public % of Schedule Risk (DB)	G18	Assumption	DB Phase % Public Schedule Allocation	F103
Table 7 – Schedule Impact Output	Private % of Schedule Risk (DB)	H18	Assumption	DB Phase % Private Schedule Allocation	F104
Table 7 – Schedule Impact Output	Public % of Schedule Risk (Oper.)	G19	Assumption	Oper. Phase % Public Schedule Allocation	F105
Table 7 – Schedule Impact Output	Private % of Schedule Risk (Oper.)	H19	Assumption	Oper. Phase % Private Schedule Allocation	F106
Table 7 – Schedule Impact Output	P10 DB Subtotal	F38	Assumption	P10 DB Schedule Impact	E111
Table 7 – Schedule Impact Output	P70 DB Subtotal	G38	Assumption	P70 DB Schedule Impact	F111
Table 7 – Schedule Impact Output	P90 DB Subtotal	H38	Assumption	P90 DB Schedule Impact	G111
Table 7 – Schedule Impact Output	P10 Oper. Subtotal	F39	Assumption	P10 Oper. Schedule Impact	E112
Table 7 – Schedule Impact Output	P70 Oper. Subtotal	G39	Assumption	P70 Oper. Schedule Impact	F112
Table 7 – Schedule Impact Output	P90 Oper. Subtotal	H39	Assumption	P90 Oper. Schedule Impact	G112

Other Project Costs (For Agency)

The “Other Project Costs (For Agency)” assumptions reflect the project costs incurred by the agency in its capacity as the project owner. These costs are estimated prior to developing the P3 Estimate as part of the project cost estimation process and the outputs from this process are used as inputs in developing the P3 Estimate.

The types of costs incurred by the agency can vary and may include costs associated with the acquisition of any Land/ROW, Procurement or Transaction Costs, Quality Assurance, Related Works, Owner Costs / Construction Engineering Costs (which include the allowable costs for environmental evaluation and documentation, permits, or approvals), or other miscellaneous project costs.¹²

The Shadow Bid Tool requires a dollar value for the other project costs identified, as well as the “Start Date (Year)” and End Date (Year)” when the costs are incurred. The start and end date columns have the option for users to select the following from drop-down menus: Base Date, Construction Start, Construction End, Operating Start, and Operating End.

Funding for Agency Costs

“Funding for Agency Costs” is an assumption that reflects how the agency may fund the costs that it incurs under the P3 delivery structure (retained risks and other project costs). An assumption may be included in the Shadow Bid Tool if the agency has a grant specifically to cover its costs, which is separate from the funding amount discussed above.

¹² FHWA, *Recreational Trails Program Guidance, 1999*

5 Cash Flow Sheets

Inputs in the “Assumptions” sheet generate sample cash flow sheets that are available to the user for educational/informational purposes. The cash flow sheets are not editable, but display nominal or real cash flows relating to the private sector cash flows, which are also reflected in the Private Cash Flow Summary Sheet. The notional example provided in the Shadow Bid Tool generates the following cash flow sheets:

- ▶ **Project Cash Flow** – Includes flags and factors based on the Timing and Inflation assumptions that are needed to generate the project cash flows.
- ▶ **Construction** – Construction phase cash flows.
- ▶ **Operations and Maintenance** – Operations and maintenance cash flows.
- ▶ **Risk** – Calculates the total risk values for cost and schedule days and the allocation between transferrable and retained risks.
- ▶ **Traffic Scenario** – If tolling is included, this sheet reflects the raw traffic and toll rates based on the Traffic Scenario selected on the Assumptions Sheet.
- ▶ **Revenue CF** – Provides the gross annual revenues per vehicle classification.
- ▶ **Toll and Other Revenue** – Applies any revenue leakage and ramp-up assumptions to the gross toll revenues and calculates any non-road revenues. After the outputs of the Shadow Bid Tool are generated, this sheet also reflects the payment amount in nominal terms.
- ▶ **Project Subsidy** – Cash flow for any funding provided to the project.
- ▶ **Project Financing** – Generates the required draw-downs from debt and equity based on the project's cost profile and calculates the cost of private finance based on the financing assumptions provided.
- ▶ **Transferrable Risk** – In a P3 procurement method, design and construction and operations phase risks are transferrable to the private contractor. This sheet allocates the equivalent value of risk to cash flows, with dollar amounts representing the expected cost consequences of a risk event occurring.
- ▶ **Depreciation** – Calculates the fixed asset values and depreciation expense that informs the Financial Statement, which is an output of the Shadow Bid Tool.
- ▶ **Private Cash Flow Summary** – Summarizes the project's cash flows for the private sector in delivering the project.
- ▶ **Other Project Costs** – Nominal cash flows for Other Project Costs, separating out the costs incurred by the agency and those incurred by the private sector.
- ▶ **Retained Risk** – Identifies the value of the risks that the agency will manage under the P3 delivery.

6 Outputs

As with the "Introduction" sheet, users must accept the disclaimer on the "VfM Disclaimer" sheet to access the Shadow Bid Tool's Output sheets. The Shadow Bid Tool is structured to provide an illustration of three different P3 delivery structures. There are various P3 delivery structures that can be identified by an agency and explored as potential P3 delivery structures for a particular project. The Shadow Bid Tool demonstrates the following P3 delivery structures:

- ▶ **Availability Payments**, where the public agency agrees to provide regular payments to the private sector based on the facility's availability and level of service achieved for operations and maintenance.¹³ The "Example Scenario" in the Shadow Bid Tool provides a notional example of an availability payment, as shown in Figure 3.
- ▶ **Real Tolls**, where the private sector partner has the right to collect all revenues generated by the project during the franchise period.¹⁴
- ▶ **Shadow Tolls** are similar to availability payments except that shadow tolls depend on traffic volume. The public agency agrees to make payments to the private operator equal to the amount of the toll that would have been imposed on users of the facility if a direct user fee had been implemented.¹⁵

Availability Payment Analysis

The light-blue drop-down box in Figure 3 indicates that the Shadow Bid Tool is set to calculate an availability payment. Pressing the "Payment Calculation" button will solve for the payment amount for each of the risk-adjusted project cash flows.

The annual nominal payment is calculated in the Shadow Bid Tool by a goal seek function. A goal seek is a 'what-if' analysis tool that calculates the input values needed to achieve a goal or objective. The goal or objective of the "Payment Calculation" is to identify the funds required to meet the required equity rate of return given the project cash flows. The "Payment Calculation" goal seek solves for this amount by selecting different payment amounts and checking if this amount is sufficient to meet the targeted equity return. The goal seek function solves the payment amount that enables the concessionaire to fund the project and provide the required return to investors. When an amount is detected that provides an after-tax cash flow equal to the required level of return, the availability payment is solved and the amount of the first annual payment is shown for the P10, P70, and P90 risk-adjusted project cash flows. Note that the availability payment is assumed to increase at the rate of inflation through the life of the concession.

¹³ National Conference of State Legislators, *Public Private Partnerships for Transportation - A Toolkit for Legislators*

¹⁴ FHWA, Office of Innovative Program Delivery website

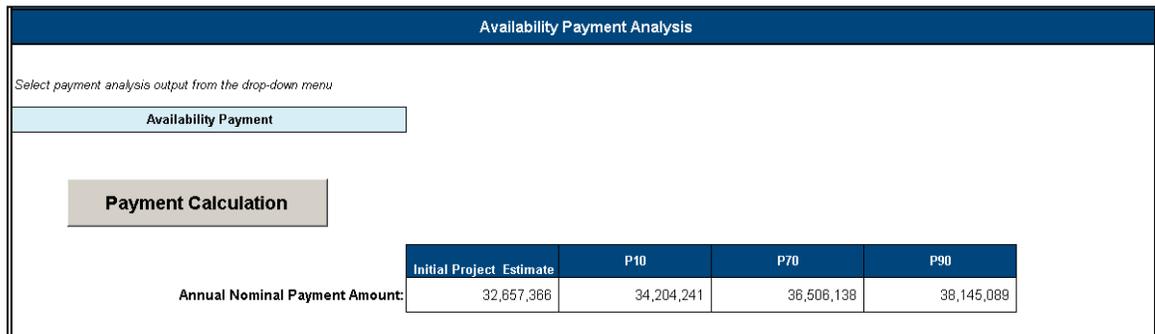
¹⁵ *Ibid*



If changes are made to the project assumptions after the payment has been solved, the availability payment needs to be solved again by pressing the “Payment Calculation” button.

The “Availability Payment Analysis” section of the “Output” sheet indicates the first annual payment, while the nominal cash flow payments are provided in the “Toll and Other Revenue” sheet. The NPC of the payment amount and the costs incurred by the agency in delivering the P3 project are shown in the “Present Value Results” and “Value for Money Analysis Results” sections of the “Output” sheet.

Figure 3: VfM Analysis - Availability Payment



Toll Scenario Analysis

The following results can be seen in the Shadow Bid Tool when "Toll Collection" is selected as part of the Project Delivery structure:

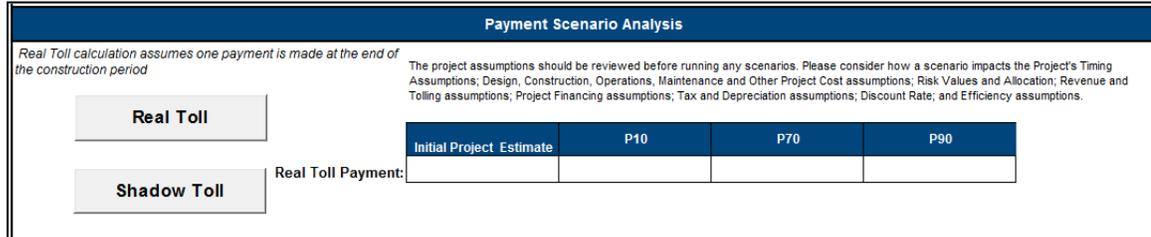
- ▶ **Availability Payment:** The Shadow Bid Tool allocates all revenue to the public agency and it is subtracted from the total payments in the "Value for Money Analysis Results."
- ▶ **Real Toll:** The private entity retains all revenues and uses this revenue to deliver the project and meet its financing commitments.
- ▶ **Shadow Toll:** The Shadow Toll utilizes the payment amount calculated under the Availability Payment scenario, and so revenues are allocated to the public entity and are subtracted from the total payments in the "Value for Money Analysis Results."

Real Toll Scenario Analysis

The "Real Toll" goal seek function for a Real Toll scenario solves a payment amount that reflects the funds that the private entity requires to deliver the project and pay its debt and equity obligations, taking into account the toll revenues it collects. The "Real Toll" goal seek function calculates this payment as one annual payment provided at the end of the construction phase. Note that the Shadow Bid tool does not address “brownfield” or hybrid brownfield/greenfield projects

where here might be surplus revenues and the concessionaire may make payments to the procuring agency for the right to keep the surplus revenues.

Figure 4: Real Toll VfM Scenario Analysis



Using the Shadow Bid Tool – Real Toll Analysis

To run a scenario where the Shadow Bid Tool provides an output for a notional real toll project, the following steps can be taken:

- Check “Toll Collection” under the “Project Delivery Structure” on the “Assumptions” sheet so that the tolling and revenue assumptions are included in the project cash flows.
- As a real toll delivery structure requires the private sector to accept demand risk and generate its revenues directly from users of the highway, the key assumptions provided in the Shadow Bid Tool need to be reviewed and updated. For example, the private sector may take a different view on the project's financing assumptions and project costs (design, construction, operations, maintenance and other project costs) to reflect its different responsibilities and also the different risk profile of its investment. The risk values will also need to be updated, along with the revenue and tolling assumptions, the project financing assumptions (to reflect the increased risk that investors are now accepting), depreciation (as the project structure has changed), the discount rate and the VfM efficiency assumptions
- Once the “Assumptions” sheet has been updated, press the F9 key to accept these changes and return to the Output sheet. Select “Real Toll” from the drop-down menu in cell B22 (refer to Figure 3).
- Press the “Real Toll” button under the “Payment Scenario Analysis” section of the “Output” sheet, as shown in Figure 4. The tool will then solve for the notional payment required by the private sector to make its investment in the real toll P3 project viable. This payment is in addition to the toll and other revenue collected by the private sector and it is estimated to be paid at the end of the construction period.
- When an amount is detected that provides an after-tax cash flow equal to the required level of return, the payment for the real toll scenario is solved and the amount of this payment is shown for the P10, P70, and P90 risk-adjusted project cash flows. The “Payment Scenario Analysis” section of the “Output” sheet indicates the total payment amount. The nominal cash flows of the payment are provided in the “Toll and Other Revenue” sheet. The NPC of the payment amount, and the costs incurred by the agency in delivering the P3 project are shown in the “NPC Results” and “Value for Money Analysis” sections of the “Output” sheet.



Shadow Toll Scenario Analysis

The Shadow Toll presents the payment as a price per vehicle, which is calculated by dividing the payment by the traffic volumes and relative toll rates for each vehicle classification. The payment amount is solved by selecting “Shadow Toll” in cell B22 and then pressing the "Shadow Toll" button in the “Payment Scenario Analysis” table. The Shadow Toll calculation is a goal seek function that works in the same way as the availability payment to identify the payments needed for the private entity to fund the project and provide the required return to investors. Toll revenues are retained by the public entity and subtracted from the total payment amount in the "NPC Results" and “Value for Money Analysis Results.” The Example Scenario is designed to model an Availability Payment and users would have to update their assumptions to reflect the additional risk the private sector would accept in linking its payment to traffic volume before running the Shadow Toll Scenario Analysis.

Figure 5: Shadow Toll VfM Scenario Analysis

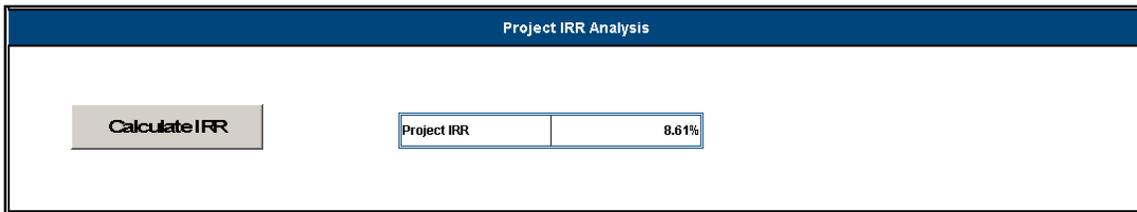
Payment Scenario Analysis				
<i>Real Toll calculation assumes one payment is made at the end of the construction period</i>		<i>The project assumptions should be reviewed before running any scenarios. Please consider how a scenario impacts the Project's Timing Assumptions; Design, Construction, Operations, Maintenance and Other Project Cost assumptions; Risk Values and Allocation; Revenue and Tolling assumptions; Project Financing assumptions; Tax and Depreciation assumptions; Discount Rate; and Efficiency assumptions.</i>		
Real Toll				
Shadow Toll	Base toll for 2 axle:	\$ 2,2089	\$ 2,2918	\$ 2,5733
	Motorcycle	\$ 1,1876	\$ 1,2322	\$ 1,3836
	3 axle	\$ 3,0105	\$ 3,1234	\$ 3,5072
	4 axle	\$ 3,6981	\$ 3,8368	\$ 4,3082

Project IRR Analysis

If the discount rate on the “Assumptions” sheet is set to “Project IRR,” the “Project IRR Analysis” is required to generate the discount rate to calculate the NPC Results (discussed below). The Project IRR for the payment analysis output selected from the drop-down menu in cell B22 (refer to Figure 3) can be calculated by pressing the “Calculate IRR” button. Once the Project IRR is calculated, the NPC Results will be generated.

The Shadow Bid Tool calculates the "Project IRR" using a goal seek function. For this function, the goal or objective is to identify the discount rate at which the net present value of the project cash flows equals zero. The goal seek function solves for this value by selecting different rates and checking if the value is sufficient to return this result. When the appropriate percentage is detected, it is shown under the "VfM Project IRR Analysis" section of the "Output" sheet and applied to the NPC Results table:

Figure 6: VfM Project IRR Analysis



The project IRR reflects risks in project delivery as well as revenue risks. Therefore, use of project IRR as the discount rate may not be appropriate for a scenario that already accounts for all the additional risk costs in project delivery and where revenue risk from tolling is not expected to be borne by the concessionaire (e.g., in an Availability Payment concession). For example, for the baseline cost scenario with a toll concession, the project IRR might be an appropriate discount rate, but for a P90 cost scenario with an Availability Payment concession, a risk-free discount rate or the procuring agency’s borrowing rate might be more appropriate. The Example Scenario’s discount rate is the public agency’s borrowing rate. Since the P3-VALUE tools do not allow the discount rate to vary by these parameters, it may be necessary to run the tools with different discount rates and financing assumptions (including equity and debt rates of return) in order to make appropriate comparisons.

If the Nominal Discount Rate is set to “Manual Input” and an input is provided, the VfM Project IRR Analysis is not required and the NPC Results will be calculated after the payment amount is solved and will be based on the discount rate provided on the Assumptions sheet.

NPC Results

The NPC Results are based on a DCF analysis of the net project costs. A DCF involves forecasting all revenue and cost cash streams (including capital expenditure) for a project into the future. The stream of free cash flow or net operating cash flow is discounted to estimate the value of the project in today’s dollars. The discount rate assumption in the Shadow Bid Tool is calculated as a discount factor for each cash flow period and is applied uniformly to all cash flows throughout the concession period. The tool does not have the ability to use different discount rates for different cash flows based on their riskiness. The following cash flows are discounted:

- ▶ Payment
- ▶ Retained Construction and Operations Risk
- ▶ Other Project Costs
- ▶ Toll & Other Revenue (when included for the Availability Payment or Shadow Toll scenarios)



These costs are presented in the “NPC Results” table and reflect the total NPC to the agency of delivering the project. The NPC Results are calculated by applying the discount rate to the payment amount, which is solved on the “Output” sheet, as well as to the retained risks and other project costs that the agency incurs in delivering the project.

The results are presented as a table of results as shown in Figure 7 and a bar graph as shown in Figure 8. The table of results presents the project costs in the first section to indicate the “Total Payments Before Revenue.” Any revenues generated by the project, such as toll revenues that are passed to the agency in an Availability Payment concession, can be reflected in the “Toll and Other Revenue” line and subtracted from the NPC to Agency to present the “Total Payments After Toll Revenue.” Note that because the Example Scenario’s Project Delivery Structure does not include toll collection, the “Toll and Other Revenue” line is blank in the screenshot below. The NPC Results are provided for:

- ▶ The initial project estimate, which excludes the risk-adjustments provided from the risk assessment process; and
- ▶ The risk-adjusted NPC at the 10th percentile, 70th percentile, and 90th percentile values.

As noted earlier, the tool uses the same discount rate irrespective of the risk level already reflected in the project cost estimates. The NPC Results Chart indicates the discount rate type and percentage, as selected and entered in the “Assumptions” sheet, in the top left corner for reference.

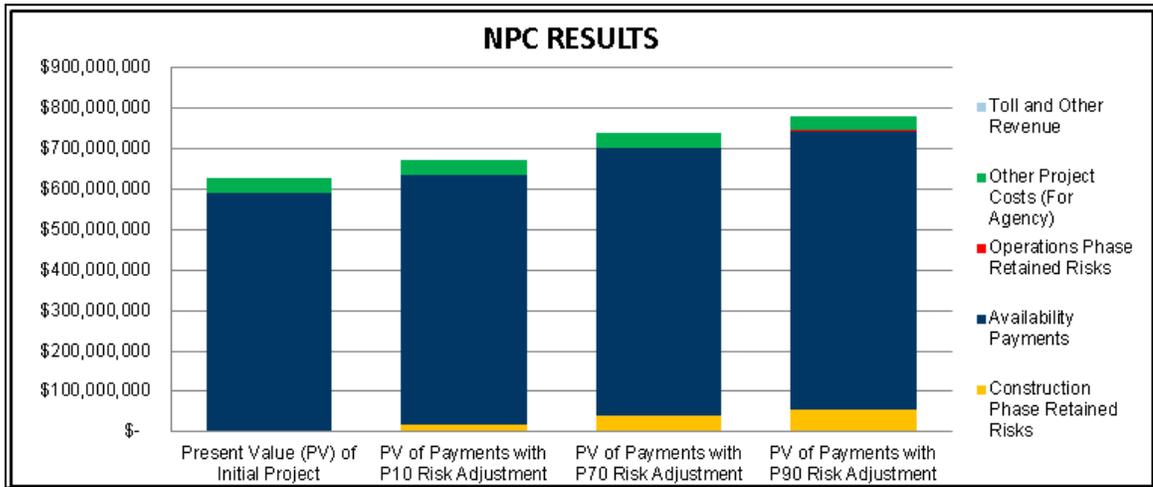
The NPC Results are notional examples provided for educational purposes only. When constructing a P3 estimate for a specific project, the output requirements will reflect the needs of the agency and the project being analyzed.

Figure 7: NPC Results Outputs Chart

Value for Money Analysis Results					
Manual Input	Initial Project Payments (\$)		Risk Adjusted Payments (\$)		
3.00%	Nominal Value of Initial Project	Present Value (PV) of Initial Project	PV of Payments with P10 Risk Adjustment	PV of Payments with P70 Risk Adjustment	PV of Payments with P90 Risk Adjustment
Payment Item					
Availability Payments	\$ 1,884,776,060	\$ 590,511,513	\$ 618,482,155	\$ 660,105,134	\$ 689,740,695
Construction Phase Retained Risks	\$ -	\$ -	\$ 16,875,193	\$ 42,016,309	\$ 53,527,869
Operations Phase Retained Risks	\$ -	\$ -	\$ 437,945	\$ 307,265	\$ 1,464,135
Other Project Costs (For Agency)	\$ 40,000,000	\$ 35,770,085	\$ 35,770,085	\$ 35,770,085	\$ 35,770,085
Total Payments Before Toll Revenue	\$ 1,924,776,060	\$ 626,281,597	\$ 671,565,377	\$ 738,198,793	\$ 780,502,784
Toll and Other Revenue	\$ -	\$ -	\$ -	\$ -	\$ -
Total Payments After Toll Revenue	\$ 1,924,776,060	\$ 626,281,597	\$ 671,565,377	\$ 738,198,793	\$ 780,502,784

The value of each cost or revenue item as shown in the table of results is also depicted in a bar graph, as shown in Figure 8. The bar graph presents the NPC to agency values:

Figure 8: NPC Results Bar Graph



Sensitivity Analysis

Sensitivity analysis is a key tool to assess how different values of one assumption can impact the overall NPC of the P3 Estimate. The Shadow Bid Tool provides a sensitivity analysis to illustrate the sensitivity of the NPC Results to changes in one key assumption. To run the sensitivity analysis in the Shadow Bid Tool, the risk percentile can be selected from the drop-down menu in the top left-hand corner. The results of the sensitivity analysis can be presented as percentage changes or dollar values by also making the appropriate selection in the top left-hand corner, as shown in Figure 9. Once these selections have been made, the sensitivity analysis will be displayed when the “Run Sensitivity” button in the top right-hand corner is pressed. The sensitivity analysis can be run after the payment analysis outputs and NPC Results have been generated.

Figure 9: Sensitivity Analysis Output

Sensitivity Analysis of Results				
Select the Risk Percentile and the Result Type from the Drop Down Menus	P10	\$		
Multiplier	Construction Costs	Operating Costs	Light & Heavy Maintenance Costs	Toll Revenue
-30%	\$ 464,131,584	\$ 665,904,652	\$ 633,938,204	\$ 671,565,377
-20%	\$ 533,003,741	\$ 667,569,571	\$ 646,258,606	\$ 671,565,377
-10%	\$ 602,337,534	\$ 669,567,474	\$ 658,911,991	\$ 671,565,377
0%	\$ 671,565,377	\$ 671,565,377	\$ 671,565,377	\$ 671,565,377
10%	\$ 740,484,202	\$ 673,230,296	\$ 683,885,779	\$ 671,565,377
20%	\$ 809,809,165	\$ 674,895,215	\$ 696,872,148	\$ 671,565,377
30%	\$ 878,923,492	\$ 676,893,118	\$ 709,525,534	\$ 671,565,377



Scenario Analysis

Users are also encouraged to run several versions of both the PSC and Shadow Bid Tools with different assumptions and to analyze how sensitive the outcomes are to changes in key assumptions. In evaluating a “real-world” project, the PSC and P3 Estimate outcomes would be displayed as a range of outcomes rather than as point estimates, as demonstrated in the P3-VALUE tools, to reflect the risks inherent in estimates.

Note that the scenario analysis solves the payment amount a number of times to generate the sensitivity analysis results, and therefore it may take several minutes for the sensitivity analysis to update.

Scenario analysis can also be an important tool in interpreting the P3 Estimate results and assessing the impact that individual assumptions have on these results. The Shadow Bid Tool provides a scenario analysis capability that enables changes to be made to key project assumptions from the “VfM Output” sheet. The scenario analysis displays the key project assumptions, their current values based on inputs provided on the “Assumptions” sheet, and arrows to adjust the value of the current assumption, as shown in Figure 10.

For an Availability Payment concession, after making changes to any of the key assumptions, users need to solve again for the payment amount by pressing the “Payment Calculation” button. Likewise, users will need to solve again for the payments amounts for the real toll and shadow toll options. Under the pre-populated Example Scenario, the lower half the table should automatically be blacked out, as should the “Toll Inflation” row because the Example Scenario’s Project Delivery Structure does not include toll collection. Figure 10 displays the Scenario Analysis table as if toll collection was selected, however, to demonstrate the full functionality of the table.

Figure 10: Scenario Analysis

Project Scenario Analysis				
<i>Press F9 to Update Results</i>				
Factor	Current Value	Units		
Concession Length	40	Years		
Construction Length	5	Years		
Construction Cost	500,000,000	\$m		
Annual Operating Cost	1,000,000	\$m		
Periodic Maintenance Cost	60,000,000	\$m		
Periodic Maintenance Period	8	Years		
Financing Interest Rate	6.50%	%		
Financing Maturity	30	Years		
CPI	2.00%	%		
Toll Inflation	0.00%	%		
After Tax Equity Return	12.00%	%		
Construction Cost Efficiency	10.00%	%		
Private Sector Schedule Efficiency	10.00%	%		
Operating Efficiency	0.00%	%		
Maintenance Efficiency	0.00%	%		
Debt Financing	85%	%		
Discount Rate	5.00%	%		
Toll Scenario <i>(Select from Drop Down Menu)</i>	Simple Toll Example			
Federal Tax	0.00%	%		
State Tax	0.00%	%		
Starting Toll Rates	Motorcycle	2 axle vehicles	3 axle vehicles	4 + axle vehicles
Toll Section 1 - Weekday - Peak	\$0.30	\$0.60	\$0.90	\$1.20
Toll Section 2 - Weekday - Peak	\$0.45	\$0.75	\$1.05	\$1.35
Toll Section 3 - Weekday - Peak	\$0.60	\$0.90	\$1.20	\$1.50
Toll Section 4 - Weekday - Peak	\$0.00	\$0.00	\$0.00	\$0.00
Toll Section 1 - Weekday - Off-Peak	\$0.00	\$0.00	\$0.00	\$0.00
Toll Section 2 - Weekday - Off-Peak	\$0.00	\$0.00	\$0.00	\$0.00
Toll Section 3 - Weekday - Off-Peak	\$0.00	\$0.00	\$0.00	\$0.00
Toll Section 4 - Weekday - Off-Peak	\$0.00	\$0.00	\$0.00	\$0.00
Toll Section 1 - Weekend	\$0.00	\$0.00	\$0.00	\$0.00
Toll Section 2 - Weekend	\$0.00	\$0.00	\$0.00	\$0.00
Toll Section 3 - Weekend	\$0.00	\$0.00	\$0.00	\$0.00
Toll Section 4 - Weekend	\$0.00	\$0.00	\$0.00	\$0.00



Financial Statement

Under the P3 delivery structure, the private sector utilizes project financing and establishes a special purpose vehicle (SPV) that is responsible for delivering the project and securing the project finance. Project financing can be limited or non-recourse to the project shareholders. In the case of non-recourse financing, a lenders' recourse is limited primarily or entirely to the project assets (including completion and performance guarantees and bonds) in the case of default of the SPV.¹⁶

The SPV's only business activity is to deliver the project, and a notional financial statement for the SPV is provided as an additional output sheet in the Shadow Bid Tool. The "Financial Statement" sheet provides the following financial information from the perspective of the SPV:

- ▶ The value of the assets generated
- ▶ The equity required and liabilities incurred in delivering the project
- ▶ The income statement, statement of cash flows and statement of equity
- ▶ The Shadow Bid cash flows

The financial statement is based on several of the private sector cash flow sheets and supports the payment calculation by estimating the payment level needed by the private sector to achieve the expected level of equity return for its shareholders (shown in the VfM Cash Flow section). It also presents the payment as revenue under the Income Statement, and indicates the SPV's tax obligations based on the VfM Tax Options and Depreciation Assumptions.

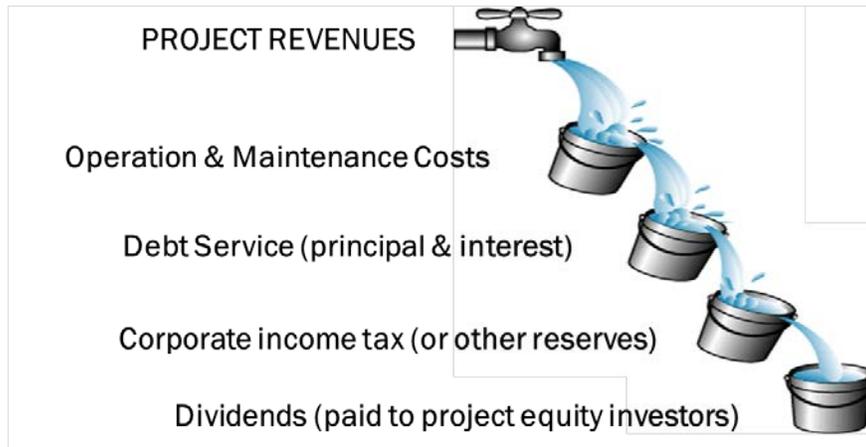
As part of the "Financial Statement" the Shadow Bid Tool provides a notional example of the SPV's income tax liability. Actual tax liabilities will vary depending on many factors including concessionaire legal structure, P3 agreements, tax jurisdictions, financing structure, tax policy and many others. The income statement provided as part of the Shadow Bid Tool's Financial Statement demonstrates the key components in estimating the notional income tax liability.

The income statement, also known as a profit and loss statement, measures financial performance over a specific accounting period, which is the concession period in the Shadow Bid Tool. It provides a summary of revenues and expenses through both operating and non-operating activities. It also shows the net profit or loss incurred over the period.

The "Financial Statement" serves an important purpose in the Shadow Bid Tool as it supports the calculation of the Cash Flow Waterfall, which illustrates the allocation of a project's cash flows. See the graphic representation of the waterfall. In the Shadow Bid Tool, the project's revenues commence during operations and can include toll revenue, non-road pricing revenue and any payments from the public agency. During construction, the private entity utilizes debt and equity to fund the risk-adjusted construction phase costs, including establishing reserve facilities.

¹⁶ The World Bank, *PPPs in Infrastructure Resource Center, Project Finance - Key Concepts*

During the operations phase, the concessionaire applies the project revenues towards the risk-adjusted project operations and maintenance costs. It then pays its debt service requirements which can include both principal and interest payments depending on the project's financing structure. The remaining funds are available for any corporate income tax or other reserves that may require additional funds.



The funds remaining are available to provide dividends to the project's equity investors. The Shadow Bid Tool optimizes the dividend payment and takes into account the working capital assumption to allocate the optimal cash flow for distribution purposes. For example, if the working capital assumption is six months, dividends are paid if the funds available for equity are greater than six months of working capital. The dividends are 'optimized' as they are paid out throughout the concession period to make the most efficient use of the project cash flows, rather than being paid out regularly during the concession period.

Using the Shadow Bid Tool

A financial statement for each risk percentile can be generated in the “Financial Statement” tab.

Select the risk percentile from the drop-down menu in cell F4.

Observe changes in the field highlighted in blue, such as the value of assets, liabilities and equity, net income, cash flows, etc.

Click “Optimize Dividend” at the bottom-left of the sheet to recalculate the after-tax cash flow required by the SPV to provide the required equity return to its shareholders.



Incorporating Outputs with other P3 VALUE Tools

The Shadow Bid Tool outputs represent the cost to the agency of the preferred P3 delivery structure. The P3 Estimate results and PSC results are incorporated into the Financial Assessment Tool for a comparative analysis between the delivery structures.

7 Summary and Tool Limitations

The *Shadow Bid Tool User Manual* is an educational resource part of FHWA's P3-VALUE suite. This User Manual corresponds to the FHWA Shadow Bid Tool, providing an overview of the value for money (VfM) process with instructions for utilizing the Shadow Bid Tool to construct a P3 Estimate. Together, these educational resources provide users with a better understanding of the process for evaluating the costs of P3 procurement against the costs of traditional procurement methods.

The information and examples outlined in the User Manual do not encompass all issues and options for constructing a P3 Estimate for a highway project. The FHWA P3 Toolkit contains additional information, as does Appendix A and Appendix C of the User Manual, for further guidance.

The Shadow Bid Tool has been designed for use in FHWA-sponsored training. FHWA anticipates that at the conclusion of the training, users will have a greater understanding and appreciation of the VfM analysis process and of several key considerations when developing a P3 Estimate. FHWA encourages users to engage appropriate experts (either in-house or external) to develop their own tools and processes for evaluating potential P3 projects. The level of knowledge gained from the FHWA training should help in such an effort.

Shadow Bid Tool Limitations

To provide a notional example of a functioning and interactive Shadow Bid Tool, a number of assumptions and formulas are included in the Shadow Bid Tool that relate to the "Example Scenario" and may not be suitable for all potential scenarios. For example, the cost, revenue, taxation and depreciation assumptions notionally provided in the tool may not be applicable for a project where the private entity is providing an upfront payment to the public entity to lease an existing asset.

The structure of a financial tool to model a P3 estimate is highly customized to reflect the unique project structure, the entities involved in the delivering the project and to maximize the funding and financing available to deliver the project for the lowest cost. The Shadow Bid Tool as well as the P3-VALUE suite have also been constructed with minimal 'black box' formulas, so users are able to view each step in the analysis process. While this provides greater clarity to users in how the outputs from each tool are produced, it also limits the flexibility of the P3-VALUE tools to accommodate an inordinate amount of project options, or to produce highly efficient results. For example, the financing structure presents one debt facility which is not optimized to make most efficient use of financing throughout the construction phase. Functions such as this would typically be seen in the financial models utilized when conducting a VfM analysis.

Appendix A: Qualitative Assessment Issues Checklist

This checklist considers various qualitative factors and corresponding questions to consider during VfM analysis. Although there is no set guidance or checklist for the United States, this checklist has been developed using examples from VDOT, Australia, and the UK.

Viability

Project Level Outputs

- ▶ Is the agency project delivery team satisfied that a long term contract can be constructed for this project?
- ▶ Is the requirement deliverable as a service and as a long term arrangement?
- ▶ Can the contract describe the requirements in clear, objective, output based measurable terms?
- ▶ Can the quality of the service be objectively and independently assessed?
- ▶ Is there a good fit between needs and contractible outputs?
- ▶ Can the contract be drafted to avoid adverse incentives and to deliver quality services?
- ▶ Is service certification likely to be straightforward in terms of agreeing to measurable criteria and satisfying the interests of stakeholders?
- ▶ Does the project have clear boundaries (especially with respect to areas of procuring agency control)?
- ▶ If there are interfaces with other projects, are they clear and manageable?
- ▶ Can the service be provided without the essential involvement of agency personnel?
- ▶ To what extent does any involvement of agency personnel negate the risk transfer that is needed for VfM?
- ▶ Is the contractor able or likely to have control/ownership of the intellectual property rights associated with the performance / design / development of the assets for the new service?
- ▶ Will existing or planned elements within the scope of the project – or related to it – be complete before the start of the new service?
- ▶ Will there be significant levels of investment in new capital assets?
- ▶ Are there fundamental issues relating to staff transfer or other workforce issues?

Facilities Management (Soft Services)

- ▶ Are there good strategic reasons to retain soft service provision in-house e.g. longer-term implications of skill transfer?



- ▶ What are the relative advantages and disadvantages? Is optimal risk allocation achieved by transfer or not?
- ▶ Is there a commitment that the assumed benefits can be delivered without eroding the overall terms and conditions for staff?

Operational Flexibility

- ▶ Is there a practical balance between the degree of operational flexibility that is desired and long term contracting based on up-front capital investment?
- ▶ What is the likelihood of large contract variations being necessary during the life of the contract?
- ▶ Can the service be implemented without constraining the delivery of future operational objectives?
- ▶ Is there confidence that operational flexibility is likely to be maintained over the lifetime of the contract at an acceptable cost?

Equity, Efficiency and Accountability

- ▶ Are there public equity, efficiency or accountability reasons for providing the service directly, rather than through a PPTA contract?
- ▶ Does the scope of the service lend itself to providing the contractor with “end-to-end” control of the relevant functional processes? Does the service have clear boundaries?
- ▶ Are there regulatory or legal restrictions that require services to be provided directly?
- ▶ Is the private sector able to exploit economies of scale through the provision, operation or maintenance of other similar services to other customers (not necessarily utilizing the same assets)?
- ▶ Does the private sector have greater experience/expertise than the procuring agency in the delivery of this service? Is the service noncore to the procuring agency?
- ▶ Is a PPTA procurement for this project likely to deliver improved VfM to the Commonwealth as a whole, considering its impact on other projects?

Overall Viability

- ▶ Is the agency satisfied that a suitable long term contract can be constructed and that strategic and regulatory issues can be overcome?

Performance/Desirability

Risk Management

- ▶ Is the private sector likely to be able to manage the generic risks associated with the program more effectively than the procuring authority?
- ▶ Bearing in mind the relevant risks that need to be managed for the program, what is the ability of the private sector to price and manage these risks?
- ▶ Can the payment mechanism and contract terms promote good risk management?

Innovation

- ▶ Is there scope for innovation in either the design of the solution or in the provision of the services?
- ▶ Does some degree of flexibility remain in the nature of the technical solution/service and/or the scope of the project? Is the solution sufficiently free of constraints imposed by the Commonwealth's legal requirements and/or the agency's technical standards?
- ▶ Does a preliminary assessment indicate that there is likely to be scope for innovation in the program?
- ▶ Could the private sector improve the level of utilization of the project assets (e.g. through selling, licensing, commercially developing for third party usage etc.)?

Contract Duration and Residual Value

- ▶ How far into the future can service demand be reasonably predicted?
- ▶ What is the expected life of the assets? What are the disadvantages of a long contract length?
- ▶ Are there constraints on the status of the assets after the contracts end?
- ▶ Given the possibility of changes to the requirement, the assets and the operating environment, is it possible to sustain VfM over the life of the contract utilizing mechanisms such as benchmarking and technology updates?

Incentives and Monitoring

- ▶ Can the outputs of the investment program be described in contractual terms, which would be objective and measurable?
- ▶ Can the service be assessed independently against an agreed standard?
- ▶ Would incentives for service delivery be enhanced through a P3 payment mechanism?

Life Cycle Costs

- ▶ Is it possible to integrate the design, build and operation elements of the project?



- ▶ Are there significant ongoing operating costs and maintenance requirements? Are these likely to be sensitive to the type of construction?
- ▶ Overall desirability Overall, is the agency satisfied that the P3 would bring sufficient benefits that would outweigh the expected higher cost of capital and any other disadvantages?

Achievability

Market Interest

- ▶ Is there evidence that the private sector is capable of delivering the required outcome?
- ▶ Does a significant market with sufficient capacity for these services exist in the private sector?
- ▶ Is there likely to be sufficient market appetite for the projects in the program? Has this been tested? Is there any evidence of market failure for similar projects?
- ▶ Have any similar projects been let to the market? Has the procuring agency's commitment to a P3 solution for this type of project been demonstrated?
- ▶ Does the nature of the project suggest that it will be seen by the market as profitable?
- ▶ Are the risks associated with design, development and implementation manageable?

Other Issues

- ▶ Is the procurement feasible within the required timetable? Is there sufficient time for: resolution of key agency issues; production/approval of procurement documentation; selection and evaluation of Proposers, negotiation, approvals and due diligence?
- ▶ Is the overall value of the project significant and proportionate to justify the transaction costs?
- ▶ Does the nature of the deal and/or the strategic importance of the work and/or the prospect for further business suggest that it will be seen by the market as a potentially profitable venture?
- ▶ Does the agency and the P3 office have the skills and resources to define, deliver and support the service throughout the procurement and the subsequent delivery period?

Overall Achievability

- ▶ Overall, is the agency satisfied that a P3 procurement program is achievable, given an assessment of the market, Authority resources and the attractiveness of the proposal to the market?



Appendix B: Glossary

This glossary contains useful terms and acronyms that are used within the Shadow Bid Tool.

Term	Description
Base Date	The Base Date is commonly referred to as the estimated date of financial/contract close for a project
Commissioning Phase	The Commissioning phase, often referred to as the Start-Up phase, is where the asset is prepared for operations. This phase often involves the testing and integration of the projects systems and components to facilitate that all applicable design criteria are met.
Concession Period	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
Construction Delay Day Cost	Construction delay per day.
Construction End	End date of construction period.
Construction Engineering Costs	The allowable costs for environmental evaluation and documentation, permits, or approvals.
Construction Period	Number of years in construction period.
Construction Phase	The Construction phase involves the actual construction of the physical asset. This phase is often the most sensitive to risks which could result in change orders, schedule delays, and contract disputes. By identifying potential risks before the start of construction phase, it may be possible for the project team to better anticipate and manage construction risks before they occur.
Construction Start	Start date of construction period.
Construction Year Index	Count for construction periods
Contingency	An allowance included in the estimated cost of a project to cover unforeseen circumstances.
Cost Impact	Cost impact is defined as the additional cost of labor, equipment and materials that are incurred when the risk event occurs and whoever is responsible for that risk has to carry out additional works as a direct result of the event. Indirect costs, such as the cost of site offices, utilities and additional resources for engineers, inspectors, etc. are not included in the cost impact.
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.
DBFO/M	Design Build Finance Operate / 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.
Debt Tranche Base Rate	Base rate of example project bond.
Debt Tranche DSCR	Required DSCR for example project bond.
Debt Tranche Debt Type	Debt facility type for example project bond.
Debt Tranche Dollar	Maximum dollar value of example project bond.
Debt Tranche Fee	Fees for example project bond.
Debt Financing Percent	Active financing percentage.
Debt Tranche Grace	Grace period for example project bond.
Debt Tranche Index	Grace period flag for example project bond.



Debt Tranche Interest Only Period	Interest only period for example project bond.
Debt Tranche Margin	Margin for example project bond.
Debt Tranche Maturity	Maturity date for example project bond.
Debt Tranche Name	The name/type of debt.
Debt Tranche Percentage	Percentage of project debt sourced from example project bond.
Debt Tranche Remaining	Remaining payment years for example project bond.
Debt Tranche Period	Interest only period for example project bond.
Design Phase	The Design phase, often referred to as a Pre-Construction phase, involves completing plans for the project such as, the development of detailed construction documents and logistics plans, issuance of permits, selecting construction materials and the construction site, and development of detailed cost and schedule estimates. During this phase, the public sector can solicit proposal or bids from qualified contractors and vendors to execute the work based on the detailed design and or operations criteria. Depending on the delivery method, the bid solicitations may take place early or late in the design phase. For example, under P3 or Design-Build, solicitations can take place early or possibly even before the Design Phase while under traditional Design-Bid-Build bid solicitations are unlikely to be issued until a complete set of construction documents is finalized towards the end of the design phase.
Design Type	Asset Type in reference to the Assumptions sheet of the Shadow Bid Tool.
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.
Discount Rate Nominal	Discount rate factoring in the inflation rate.
Discount Rate Real	Discount rate that does not account for inflation.
DSCR	Debt Service Cover Ratio
Finance	Finance refers to the 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.
Inflation Consumer Price Index	Inflation Consumer Price Index used as a base rate for inflation assumptions.
Leveraging	Leveraging is the degree to which an investor or business is utilizing borrowed money.
Maintenance	The maintenance 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.
Non-Road Pricing Revenue	Non-road pricing revenues cover a vast landscape of strategies to help pay for non-tolled improvements or facilities, such as transit.
Non-Agency Subsidy	Percentage of construction costs provided by non-agency government subsidy.
Net Present Cost (NPC)	Net Present Cost is the estimated cash flows associated with PSC analysis.
Net Present Value (NPV)	Net Present Value is the present value of the expected future cash flows minus the cost.
NPC Base	Net Present Cost of the base project (excluding risk).
NPC P10	NPC of the project at the 10th risk percentile.
NPC P70	NPC of the project at the 70th risk percentile.
NPC P90	NPC of the project at the 90th risk percentile.
Operations Phase	During the Operations phase, the completed asset is operated and maintained to facilitate continuation of beneficial use and/or revenue generation over the life of the asset. Operations refer to the process of ensuring the continuing performance and availability of the highway, which includes removing debris and snow and collecting tolls and data on traffic.
Periodic Maintenance	Repairing damage normally expected from seasonal and occasionally unusual natural conditions or occurrences.
Periodic Maintenance Cost Period	The time period between periodic maintenance works.



Planning Phase	Planning is the earliest phase of the project in which the project is purely conceptual with relatively low design definition, and very rough high level estimates of the cost and schedule. Tasks in this phase typically consists of financial and technical feasibility studies, development of rough budget and schedule estimates, public forums if applicable, and an assessment of existing assets for a replacement or renewal project.
Post Operating Costs	Operating Costs post construction completion.
Pre Operating Costs	Operating Costs before construction completion.
Primer	Within the context of the <i>Value for Money Tool User Manual</i> , “Primer” refers to the FHWA’s <i>Primer on Value for Money Assessment for Public-Private Partnerships</i> , which provides an overview of general/basic concepts of the VfM and PSC development processes. Also, FHWA’s <i>Primer on Financial Structuring and Assessment</i> provides an overview of basic financing concepts.
Procurement Phase	Stage at which a pool of bidders is down-selected based on specific criteria.
Project Financing	The percentage of total construction cost and project cost that are not funded by subsidy that will be funded by debt financing.
Public Sector Comparator (PSC)	The 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 (in reference to a type of Project Cost in the Assumptions sheet of the Shadow Bid Tool).
Risk Allocation	The process of assigning operational and financial responsibility for specific risks to parties involved in the provision of services under P3. Also see 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	Routine Maintenance is defined as 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.
Schedule Impact	Schedule impact is defined as the delay that the event may cause to the project schedule.
P3 Estimate	P3 Estimate refers to a financial model created based on P3 procurement. It is called a P3 Estimate because it is an estimate based on an expected bid.
T&R	Traffic and revenue.
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.

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