The Commonwealth of Virginia

P3 Value for Money Guidelines

June 2016

Document Version control

Version	Date Issued	Comments
1.0	April 2011	First version
2.0	August 2012	Industry comments and revisions
3.0	June 2016	Updated version with significant revisions

Table of Contents

1 INTRODUCTION

1.1 PURPOSE OF THE VFM GUIDELINES

The Public-Private Transportation Act of 1995 (PPTA) is the legislative framework that enables the Commonwealth of Virginia, qualifying local governments and certain other public entities to enter into public-private partnerships (P3s) to acquire, construct, improve, maintain, and/or operate qualifying transportation facilities.

The P3 Value for Money Guidelines (VFM Guidelines), a companion document to the PPTA Implementation Manual and Guidelines, were developed to assist the Virginia Office of Public-Private Partnerships (VAP3) and Responsible Public Entities (RPEs) with the preparation of a value for money (VFM) comparison of potential project delivery options.[1] The VFM comparison can help decision makers assess the potential costs and risks associated with different options for managing and financing the design, construction, operation, and maintenance of a project over a defined period of time (Project Delivery Options). Potential benefits that cannot be expressed in terms of lower life-cycle costs or reduced risk can be addressed qualitatively.

1.2 ROLE OF VFM IN VIRGINIA P3 PROJECT DELIVERY FRAMEWORK

Under the P3 project delivery framework outlined in the PPTA Implementation Manual and Guidelines, an initial VFM comparison is prepared early in the project development phase, based on preliminary assumptions and estimates, to help decision makers assess the potential costs, risks and opportunities associated with the financing, design, construction and operation of the project under different project delivery options. If the project scope, the anticipated risk allocation, or other key assumptions are modified during the development phase, the initial VFM comparison should be updated."

At the conclusion of the project development phase, VAP3 and the RPE will brief the Oversight Board on the results of the initial VFM comparison and other relevant analyses before the Board decides whether the project should continue to the procurement phase.[2] If a decision is made to initiate a P3 procurement, a final VFM comparison is prepared prior to the execution of a P3 agreement. The inputs and assumptions used in the initial VFM comparison are reviewed and updated to reflect revised cost estimates and risk analysis as well as the proposed contract terms included in the final P3 Request for Proposals (RFP). The final VFM comparison is one of several information items prepared for the Oversight Board to help determine whether a P3 delivery option continues to offer value compared to other options and is in the best interest of the Commonwealth.

[1] A Responsible Public Entity (RPE) is a public entity that has the authority to develop and/or operate a qualifying transportation facility (§ 33.2-1800). For purposes of the PPTA Manual and Guidelines and VFM Guidelines, the RPE is also referred to as "Agency."

[2] Oversight Board means the Oversight Board for the respective Agency. For example the Commonwealth Transportation Board (CTB) serves as the Oversight Board for the Virginia Department of Transportation and the Department of Rail and Public Transportation.

Pursuant to the PPTA Implementation Manual and Guidelines (Section 5.4), if the RPE, during the procurement of a P3 project, modifies the procurement documents in such a manner as to materially change the scope or alter the proposed delivery method, then the RPE shall conduct a full value assessment of the current and proposed procurements, to include at a minimum, a VFM comparison. Once the value assessment has been completed, the RPE will make a presentation to the RPE's Oversight Board to present the value assessment and seek a resolution from the Oversight Board to continue the procurement with the proposed material changes or terminate the procurement.

1.3 STRUCTURE OF THE DOCUMENT

This Introduction describes the purpose of the VFM Guidelines and the role of VFM comparison in the Virginia P3 project delivery framework. Section 2 provides guidance on preparing a VFM comparison. The final section outlines the information that should be provided when reporting the results of a VFM comparison.

The appendices provide definitions for many of the technical terms and concepts used in this guidance and additional information on the financial analysis required to quantify VFM.

2 VALUE FOR MONEY COMPARISON

2.1 WHAT IS A VALUE FOR MONEY COMPARISON?

A VFM comparison provides information that can help decision makers evaluate the relative merits and tradeoffs associated with using a P3 delivery option to develop a particular project versus more traditional public sector procurement options. Traditional public sector procurement options include Design-Bid-Build or Design-Build, where the RPE pays for project costs as they are incurred and retains responsibility for operating and maintaining the project after completion of construction. The objective is to provide a detailed comparison of the delivery options that reflects the total cost to design, build, finance, operate and maintain the project after explicitly considering the estimated value of project risks retained or transferred by the RPE under each delivery option.

The components of a VFM comparison are similar in some respects to financial feasibility studies, cost-benefit analyses, and project risk analysis, so it is important to note the following distinguishing features:

Direct Comparison of P3 and Public Options – A VFM comparison is based on an analysis of two or more project delivery options. The options can vary, but they typically include a traditional public sector procurement approach referred to as the "public sector comparator" (PSC). The PSC is compared to an alternative project delivery approach under which some of the responsibility and risk associated with the design and construction, financing, and/or operation and maintenance (O&M) of the project is transferred to, or shared with, a private sector partner. The P3 option is often called a "shadow bid" because it is a proxy for the potential proposal that might be submitted by a private consortium if the project advances to the P3 procurement stage. The shadow bid assumptions are updated for the final VFM comparison based on the P3 proposal determined to offer the best value to the RPE.

Qualitative and Quantitative Analyses - A VFM comparison includes both a qualitative and quantitative analysis of the differences between the project delivery options that are evaluated. The results of a cost-benefit or financial feasibility analysis can often be summarized with single number, such as a return on investment ratio or an estimate of the public subsidy that may be required to advance a project. The VFM comparison includes a financial analysis but it also has to provide the qualitative analysis of the strengths and limitations of each project delivery option and address factors that are relevant to a decision to pursue a P3, but are difficult to quantify in monetary terms.

Comprehensive Cost Estimates - A VFM comparison is based on estimates of all costs expected to be incurred to finance, construct, operate, and maintain the project over a defined period of time that is typically based on the estimated useful life of the project or the term of the potential P3 agreement based on some other metric. The estimates should include costs borne by the RPE under each option for procurement and oversight during the term of the project as well as potential transition costs that may be incurred by the RPE after the P3 agreement ends. The focus on the "whole life" cost of the project in a VFM comparison facilitates evaluation of long-term risks associated with each delivery option and the identification of opportunities for greater efficiency and innovation.

Risk-Adjusted PSC Costs – The cost estimates for a P3 in a VFM comparison generally reflect the project risks to be assumed by the private partner during construction and O&M phase, the potential increase in efficiency and innovation given the financial incentives in the P3 agreement, and the cost of providing private financing, when applicable. The P3 cost estimates can also be adjusted to reflect any unique risks or obligations incurred by the RPE under the P3 option. To provide a fair comparison of the delivery options, the cost estimates for a PSC in a VFM comparison have to be adjusted to reflect the potential value of the transferable risks retained by the RPE under the PSC. The cost estimates for a P3 option, for example, might assume it will cost the private partner a certain amount to operate and maintain a roadway over a 40 year term. Under that P3 scenario, the risk that actual O&M costs might be higher than originally assumed is borne solely by the private partner. Under the comparable PSC, the RPE may estimate that it could maintain the project for an amount less than P3 cost estimate, but the PSC cost estimate should then be adjusted to reflect the potential risk that O&M costs could be higher than estimated. The amount of the risk adjustment is typically based on a financial calculation that reflects the potential cost impact and the likelihood that the risk will occur over the defined period of time.

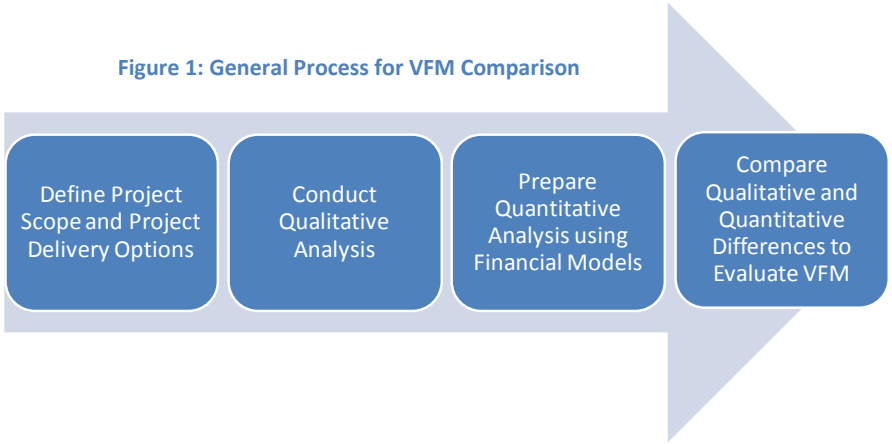
2.2 OVERVIEW OF THE PROCESS

The general process for conducting the initial VFM comparison can be summarized as follows:

- Define the scope of the project and the project delivery options to be evaluated;
- Conduct a qualitative analysis of the options to highlight the key differences and potential policy considerations;
- Start the quantitative analysis of the options by preparing estimates of the cost to construct, operate, and maintain the project under each project delivery option;
- Create financial models for each project delivery option to determine the total costs associated with financing the project and the amount of project revenue, if any, that might be available for the RPE after payment of all project obligations;

- Estimate the monetary value of key project risks retained by the RPE under each option;
- Conclude the quantitative analysis by comparing the total risk-adjusted cost of each delivery option in present value dollars; and
- Provide decision makers with a VFM comparison by summarizing the qualitative and quantitative differences between the project delivery options.

Figure 1: General Process for VFM Comparison



The following sections describe each step of the process in more detail.

2.3 DEFINE THE PROJECT DELIVERY OPTIONS TO BE EVALUATED

The first step in a VFM comparison is for the RPE to define the project and the project delivery options that will be evaluated. In some cases, the project will already be in the early stages of development using a traditional procurement approach. If not, the RPE will have to select a project delivery option to serve as the PSC. Common options for the PSC are:

- **Design–Bid–Build (DBB) -** Under DBB, the design and construction of the project will be procured under separate contracts. The public owner remains responsible for setting the design specifications and then financing, operating, and maintaining the project.

- **Design–Build (DB) -** With DB delivery, a design-build contractor assumes responsibility for the majority of the design work and all construction activities, as well as any project development risks specified in the competitive bidding process. When using DB delivery, the public owner retains responsibility for funding or financing, operating, and maintaining the project.

The RPE will also select the P3 delivery option(s) to be evaluated in the VFM comparison. Under Virginia's P3 project delivery framework, there is a two-phase screening process for projects that are candidates for delivery under the PPTA. The High-Level and Detail-Level Screening Reports prepared by VAP3 and the RPE will identify one or more options for potential P3 delivery which can then be refined for the VFM comparison. Common P3 delivery options include:

- **Design–Build–Finance–Operate–Maintain (DBFOM)** - Under the DBFOM approach, the responsibility for design, construction, finance, operations and maintenance is bundled together

and transferred to private sector partners. The private partners will finance all or a portion of the project cost by leveraging user fees (tolls) and/or payments from the RPE.

- **Design–Build–Operate–Maintain (DBOM)** - With a DBOM contract, a private entity is responsible for final design and construction as well as long-term operation and/or maintenance services. The RPE funds the project, subsidizes any shortfalls in operating revenue and retains any surplus operating revenue.
- **Design–Build–Finance (DBF)** - With DBF delivery, the private sector partner assumes responsibility for final design, construction activities, and financing for all or a portion of the construction costs. The RPE remains responsible for securing the funding that will be used to repay the construction financing and it retains responsibility for the long-term operation and maintenance of the project.

  The DBF approach can take many forms. The private sector partner, for example, could secure relatively short-term financing that is retired after construction is complete. Some entities may be willing to make a private equity investment over a longer term if given the opportunity to manage the tolling operations. The financing component could also be undertaken by a private non-profit corporation that issues non-recourse, tax-exempt revenue bonds.

This guidance discusses the comparison of two project delivery options, a PSC and a P3 arrangement, but if multiple PSC and P3 options are viable for a particular project, the VFM comparison should be expanded to provide decision makers with a more comprehensive review of the alternatives.

2.4 CONDUCT QUALITATIVE ANALYSIS

The purpose of the qualitative analysis is to highlight key differences between the project delivery options and to address issues that are relevant to the overall value for money determination but are difficult to quantify in monetary terms. Those issues will vary depending on the type of project and the level of project definition and development, but the factors considered will generally relate to the policy and management objectives identified by the RPE for the procurement. Examples of potential issues to be evaluated include:

- The ability of the public agency to solicit and evaluate innovative technical and financial ideas concepts that may reduce costs and/or expedite project completion;
- Potential incentives under each option for the contractor to optimize design to reduce life-cycle costs and to undertake ongoing improvements with minimal impact to operations; and
- Required contract provisions under each option that may limit the RPE's ability to respond to future challenges and opportunities.

The qualitative analysis of the project delivery options is conducted by VAP3 after consulting with the RPE on key policy objectives. Potential sources of information include the reports prepared as part of the P3 screening process, the results from risk workshops, and input from project stakeholders and the general public.

The qualitative analysis is one component of the VFM comparison and the results should be presented in a manner that facilitates comparison of the project delivery options. Provided below is an example of one way to summarize the information.

Table 1: Example of the Qualitative Analysis for a VFM comparison

Potential Strategic Objective	Public Sector Comparator	P3 Option
Encourage innovation that reduces project costs and expedites completion	*Separate contracts for construction and operations and maintenance may hinder the development and implementation of alternative approaches.*	*Teams competing for the P3 opportunity will have significant expertise, and financial incentive, to explore options that can expedite project completion and reduce project costs.*
Optimize design to reduce life-cycle costs and the operational impact of future improvements	*The RPE may have to commit resources upfront to optimize design before soliciting construction bids. RPE will bear cost of any impacts on operations from future improvements.*	*Integration of design, construction, financing, and operations and maintenance under one entity facilitates the evaluation and management of life-cycle costs.*
Provide flexibility for the RPE to respond to future challenges and opportunities	*Project contracts will likely have relatively short terms which will facilitate any policy changes needed to respond to unanticipated events or circumstances.*	*The P3 agreement can include provisions to enable negotiation of potential changes over the 40 to 50 year term, with appropriate compensation when required.*

2.5 PREPARE QUANTITATIVE ANALYSIS

The quantitative analysis requires development of project cost estimates, creation of financial models for each delivery option, and valuation of project risks. Financial consultants and other outside experts are typically engaged to assist with these activities. The following discussion describes each component of the quantitative analysis in more detail.

2.5.1 Develop Capital and Life-Cycle Cost Estimates

VAP3 and the RPE will develop estimates of the cost to procure, design, build, operate, and maintain the project under each project delivery option over a defined period of time, typically based on the expected useful life of the infrastructure that will be built or the length (in years) of the potential P3 agreement. The term of the P3 agreement will vary depending on the financing approach, the scope and timing of capital renewal and replacement work, and the RPE's need for flexibility to consider other opportunities in the future.

The cost analysis for each delivery option should be comprehensive and include, at a minimum, the following:

- RPE oversight and administration costs during project development, implementation, and operation;
- Pre-construction costs (including project development, design, engineering, procurement and environmental review costs);

- Construction costs (including mobilization, utility relocation, environmental mitigation, storm water management, right of way, material/equipment/labor, Traffic Demand Management (TDM) strategies, and construction management);
- Operations and maintenance costs (based on the same performance standards or service levels for each option), including routine (cyclical and preventative) repairs and maintenance and major maintenance and renewal; and
- Tolling operations, maintenance, and transaction costs (as applicable).

The capital and life-cycle costs outlined above will be inputs to financial models that will be used to develop estimates of the financing costs associated with each project delivery option. It is important that key assumptions are documented and consistent with those used for other project evaluations, such as the risk analyses required under Virginia's P3 project delivery framework.

The cost estimates can be developed in constant base year dollars and escalated to nominal year-of-expenditure dollars to derive the annual funding requirements for each option. The cost escalation rate(s) used to account for potential inflation of various expenditures should be determined by VAP3 and the RPE. The Financial Division of the Virginia Department of Transportation (VDOT), for example, provides the annual inflation factors used in VDOT's Project Cost Estimating System.

2.5.2 Create Financial Models

To evaluate the costs associated with the funding and financing assumptions for each project delivery option, spreadsheet-based project finance models are created. The structure of the financial models developed for a VFM comparison can vary, but the basic inputs are the capital and life-cycle cost estimates and forecasts of the revenue that might be available for the project. Revenue generated by the project may come from tolls or other user fees or may be provided from other sources such as dedicated taxes or appropriations.

The primary output of the financial model is a cash flow schedule for each project delivery option that shows how the various funding sources will be used over time to pay the project costs, debt service, required deposits to project reserves, distributions to equity investors (if applicable) and cash flows back to the RPE.

A more detailed discussion of typical financing assumptions for the quantitative analysis component of a VFM comparison is provided in Appendix B.

2.5.3 Estimate Monetary Value of Project Risks

To provide a comparative analysis of the total potential cost of each project delivery option, it is necessary to identify and calculate the monetary value of the major risks that may be assumed, transferred or shared by the RPE under the PSC and the P3 options. The estimated value of the risks to the RPE is then added to the cost estimates developed for each project delivery option to create a "risk-adjusted" cost to the RPE.

The P3 Risk Management Guidelines describe in detail how to conduct the risk analyses needed to generate the data for the VFM comparison, but in general, the monetary value of a particular project risk is determined by quantifying the potential cost and schedule impacts for the identified risk and multiplying that amount by the probability of the risk occurring (based on historical data or statistical analyses).

At the early stages of project development, the initial project risk analysis may be qualitative in nature and therefore preclude detailed calculation of the monetary value of every project risk associated with each project delivery option. This is due in part to the fact that environmental reviews are not yet complete and final location decisions have not yet been made, so there may still be some uncertainty about the project scope. In those situations, it is appropriate to focus on the major risks that can be transferred to, or shared with, the private sector and to develop order-of-magnitude estimates of the monetary value of those risks by making adjustments to the project cash flows or other key assumptions.

In situations where the project development and construction schedule for the PSC is significantly longer than for the P3 option (under a "design-bid-build" approach, for example), it is also appropriate to consider the potential economic costs that are incurred when critical improvements are deferred, such as increased congestion and accidents or failure of the existing assets.

2.5.4 Compare the Net Present Value of the Risk-Adjusted Costs

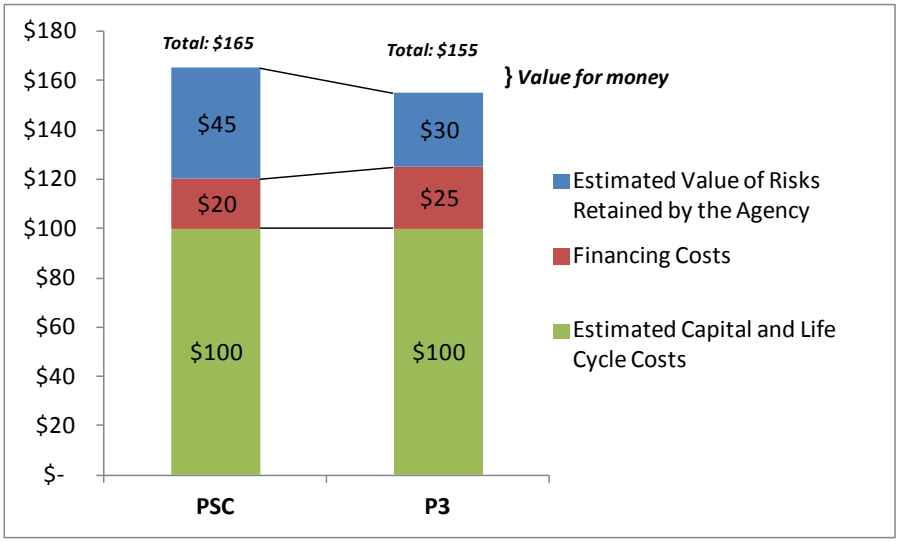
The last step in the quantitative analysis for the VFM comparison is to compare the estimated costs and revenue to the RPE under the PSC option and the P3 approach. That is done by discounting the cash flows developed for each option so that the amounts can be expressed in dollars at the same point in time. That calculation – the Net Present Value (NPV) analysis – is the appropriate way to compare differing streams of costs and revenue over a long period of time.

In the NPV analysis, the future cash flows for each option are discounted back to a specific base year using the same discount rate. The discount rate is an annual interest rate that reflects the time value of money (the concept that a dollar today is worth more than a dollar in the future) and the risk or uncertainty associated with the future cash flows. The discount rate selected by VAP3 and the RPE for the VFM comparison should be comparable to the weighted average cost of capital assumed in the financial models because those rates generally reflect conditions in the capital markets and the risk premiums required by investors. A sensitivity analysis showing the impact of using different discount rate assumptions should be provided to decision makers.

The risk-adjusted cost to the RPE of the traditional project delivery option is the NPV of the project cash flows developed for the PSC with adjustments for financing costs and the value of risks that are retained by the RPE. That cost is compared to the net present value of the project cash flows developed for the P3 option. If the cost of the P3 option is lower than the risk-adjusted cost of the PSC, the P3 delivery option provides "value for money" and the "savings" are usually expressed as a percentage of the cost of the PSC.

The figure below illustrates the comparison. In this example the total risk-adjusted cost of the PSC is $165, expressed in present value dollars, compared with $155 for the P3. The $10 difference is referred to as value for money and it is approximately six percent of the cost of the PSC in this hypothetical example.

Figure 2: Illustrative VFM Calculation



2.6 SUMMARY OF KEY INPUTS AND OUTPUTS

The chart below summarizes the key inputs and outputs for a VFM comparison as discussed above.

Figure 3: Key Inputs and Outputs for a VFM Comparison

INPUTS	PROCESS	OUTPUTS
▪ P3 Screening Reports ▪ Project Risk Analyses ▪ VAP3/RPE/Stakeholder Review of Delivery Options	Qualitative Analysis	Matrix or table that highlights differences between the delivery options with regard to RPE objectives
▪ Capital Cost Estimates ▪ O&M and Life-Cycle Cost Estimates ▪ Project Revenue Forecasts ▪ Financing Assumptions for Each Delivery Option ▪ Risk Valuations	Quantitative Analysis using financial models	Net present value of the project cash flows developed for each delivery option after adjusting for financing costs and the value of risks that are retained by the RPE

The findings from both the qualitative and quantitative analyses in a VFM comparison are important, so any conclusions or recommendations provided to decision-makers should not be based solely on the comparison of the estimated net present value costs. For example, under certain circumstances, it may be appropriate to select a traditional project delivery option (PSC) with a higher risk-adjusted cost estimate than the alternative in order to retain greater flexibility to respond to challenges or opportunities that are anticipated in the future.

3 REPORTING FORMAT FOR VFM COMPARISON

Outlined below is the recommended format for reports that present the results of an initial or final VFM comparison. Under the project delivery framework outlined in the PPTA Implementation Manual and Guidelines, the RPE Oversight Board is briefed on the results of the initial VFM comparison at the end of the project development phase. The findings from the final VFM comparison are presented to the Oversight Board prior to the execution of a P3 agreement. The format for those briefings is left to the discretion of the RPE and VAP3. Certain proprietary records and trade secrets may be protected from disclosure under the Virginia Freedom of Information Act pursuant to Sections 2.2-3705.6 and 33.2-1820 of the Code of Virginia.

3.1 EXECUTIVE SUMMARY

The executive summary is a brief synopsis (two or three pages) of the purpose and findings of the VFM comparison. It provides clear descriptions of the project delivery options that were evaluated.

3.2 PROJECT SCOPE AND BACKGROUND INFORMATION

The introduction to the report will provide context for the VFM comparison by briefly describing the scope of the proposed project, the strategic objectives for the planned procurement, and the status of project development efforts.

3.3 QUALITATIVE ANALYSIS OF PROJECT DELIVERY OPTIONS

The qualitative analysis is summarized in a manner that facilitates comparison of the project delivery options. As shown below, for example, a matrix or table can be developed that shows whether each project delivery option satisfies the strategic objectives identified for the project.

Figure 4: Example of Summary Chart for a Qualitative Analysis

Potential Strategic Objective	Public Sector Comparator	P3 Option
Encourage innovation that reduces project costs and expedites completion	PARTIAL	☑
Optimize design to reduce life-cycle costs and the operational impact of future improvements	PARTIAL	☑
Provide flexibility for the RPE to respond to future challenges and opportunities	☑	PARTIAL

3.4 QUANTITATIVE ANALYSIS OF VFM

The quantitative analysis identifies the key cost inputs and financing assumptions (if applicable) used in the VFM comparison. The discussion highlights the process used to develop or obtain estimates of the cost to procure, build, operate, and maintain the project under each delivery option and to determine the estimated monetary value of major risks retained by the public agency.

It is important to document all assumptions for the cost estimates and to present cash flows in both a constant (base-year) and nominal (year-of-expenditure) dollars when appropriate. The table below provides an example of how the results of the quantitative analysis can be summarized to facilitate comparison of the options. The results of any sensitivity analysis or probability simulation undertaken to assess the robustness of the results should also be presented.

Figure 5: Example of Summary Chart for a Quantitative Analysis

Cost Category	Public Sector Comparator		P3 Option	
	Nominal $	NPV $	Nominal $	NPV $
Estimated Capital and Life-Cycle Project Costs (1)				
Adjustment for Funding/Financing and Residual Revenue (2)				-
Adjustments for Estimated Value of Project Risks				
Total Risk-Adjusted Cost Estimate for VFM Comparison		**$A**		**$B**
Estimated Value for Money *(incremental cost/savings with PSC)*				**$A - $B**
VFM as percentage of PSC				**($A -$B)/ $A**

(1) Includes procurement, design and construction, operations and maintenance, renewal and replacement.

(2) Represents the potential net cost to the RPE of each project delivery option after considering the amount of direct public investment (in the form of public grants) and the amount of residual revenue that may be available to the RPE after required payments.

3.5 SUMMARY AND CONCLUSIONS

The summary describes the results of the quantitative and qualitative VFM analyses and suggests next steps that can be taken to facilitate future decision-making.

APPENDIX A: DEFINITIONS

Provided below are definitions for certain terms used in the VFM Guidelines.

Agency means any Agency of the Commonwealth of Virginia.

Discount Rate means the yield used to calculate the present value of a future series of cash flows (costs and revenues), reflecting the time value of money and the risk factors associated with the projected cash flows.

Life-cycle Costs means costs typically associated with planned or scheduled replacement, renewal and/or refurbishment of facility assets such as roadway, bridges, systems, equipment and fixtures that have reached the end of their useful life during the project term.

Project Delivery Option means the approach taken by a public agency for developing and financing design, construction, operations, and maintenance services for a structure or facility by entering into legal agreements with one or more entities or parties.

Project Risks means events that can lead to significant cost increases, construction delays, or both should they occur.

Public-Private Partnership (P3) means a project or service which is delivered, operated, maintained and/or financed through long-term contractual arrangements between a government entity and one or more private entities.

Public Sector Comparator (PSC) means the estimated total cost to the public sector, including the value of retained risks, of delivering an infrastructure project using traditional procurement methods.

Responsible Public Entity (RPE) means a public entity, including local government and regional authority that has the power to develop and/or operate a qualifying transportation facility in accordance with the PPTA.

Retained Risks means the Project Risks which are not transferred or shared with a private partner because the RPE has determined that to do so would not provide best value.

Revenue Risk means the risks associated with the realization of the revenue that is expected to be generated from tolls, user fees or other sources.

Risk-Adjusted Cost means the total cost to deliver a project after adding the estimated monetary value of the major risks that may be retained or shared by the RPE.

Risk Analysis means the systematic process to understand the nature of and to deduce the level of risk on a project.

Shared Risk means risks that are allocated among two or more parties, where the threat of a loss or the benefit of the gain of a particular risk is proportionally shared as determined by the agreed allocation.

Value-for-Money (VFM) Comparison means the comparison of the estimated risk-adjusted cost to deliver a project using traditional public sector delivery options and alternative options involving public-private partnerships.

APPENDIX B: TECHNICAL NOTES FOR THE QUANTITATIVE ANALYSIS

This appendix provides additional guidance for the quantitative analysis component of the VFM comparison. Every project has aspects that are unique, so it is difficult to anticipate every input or assumption that may be required for the VFM comparison. This discussion therefore is primarily intended to illustrate the basic concepts and to serve as a starting point for the quantitative analysis.

As outlined in the VFM Guidelines, the preparation of the quantitative analysis generally involves the following activities:

1. Develop capital, operations and maintenance, and life-cycle cost estimates for each project delivery option,
2. Create financial models to determine potential cash flows to and from the RPE under each project delivery option,
3. Estimate the monetary value of major project risks retained, shared or transferred by the RPE, and
4. Compare the net present value costs to the RPE under each project delivery option to determine Value for Money.

To help illustrate the concept, the discussion below describes how each step in the process might be applied to a hypothetical highway project that involves the construction of express toll lanes. For purposes of this example, two project delivery options are compared:

- *P3 Toll Concession*: This scenario assumes the RPE will enter into a long-term agreement with a private consortium to design, build, finance, operate and maintain the Project for a period of forty year, including construction. The private concessionaire will be responsible for financing a significant portion of the construction cost with proceeds from private equity investment, tax-exempt private activity bonds (PABs), and a Federal loan provided under the Transportation Infrastructure Finance and Innovation Act (TIFIA) program.

- *Design-Build Construction Contract with Public Financing*: This is the public sector comparator (PSC). Under this scenario, the RPE finances a significant portion of the capital costs with proceeds from toll revenue bonds and a TIFIA loan. Competitive bids for a design-build construction contract and the contract for operation and maintenance of the toll facility are assumed to be solicited separately. The RPE will use net toll revenue available after payment of toll operations and routine roadway maintenance and debt service to fund the cost of highway renewal and replacement over 40 years.

Step 1 - Develop Capital and Life-Cycle Cost Estimates

The required cost estimates can generally be categorized as follows:

- *Design and Construction* - Typically based on planning level estimates of the cost to design and construct the proposed improvements, including mobilization, utility relocation, environmental mitigation, right of way acquisition, material/equipment/labor, and construction management.

- *Operations and Maintenance* – Annual cost to operate and maintain the toll collection system, when applicable, and the cost to perform routine repairs and maintenance on the highway and related infrastructure.

- *Renewal & Replacement* – Costs associated with planned renewal or replacement of assets that have reached the end of their useful service life. Also referred to as life cycle costs because they are typically performed in cycles over a long period of time.

- *Procurement & Agency Management* - Cost to the RPE to perform contract oversight and administration during project development, implementation, and operation.

Table B1 on the next page shows the cost estimates created for the hypothetical express lanes project. The cost estimates for each category are shown in constant base year dollars and then escalated to nominal year-of-expenditure dollars to derive the annual funding requirements for each project delivery option. The assumed cost escalation rate of 2.50% is a proxy for potential inflation.

In the hypothetical example, private sector innovation and efficiencies are assumed to result in capital costs, O&M expenses, and renewal and replacement costs for the P3 scenario that are 98% of the estimates for the PSC. The cost for RPE oversight is assumed to be the same for the PSC and P3 scenarios during construction. After construction, the RPE oversight cost under the P3 scenario is 5 percent lower than the assumption for the PSC since the private sector will actively manage the project.

Step 2 – Create Financial Models

Financial models are created to evaluate the costs associated with the financing assumptions for each project delivery option. The complexity and structure of the spreadsheet-based financial models developed for a VFM comparison will vary, but the basic inputs are the capital and life-cycle cost estimates developed in Step 1 and forecasts of the revenue, if applicable, that is expected to be generated from tolls, user fees or other sources. The financial model is used to determine the optimal amount of project debt, private equity (when applicable), and public grants (together, the "capital structure") for each project delivery option. The outputs of the financial model include a table that summarizes the assumed sources and uses of funding during the construction period and a cash flow schedule that shows how the projected revenue will be used each year to pay O&M costs, to repay investors, and to fund reserve accounts for renewal and replacement and other costs.

Typical sources of funding for public infrastructure projects include tax-exempt revenue bonds, commercial bank loans, subordinated TIFIA loans, private equity investments, and public grants from Federal, state or local entities. The determination of which funding sources to use and how to structure the repayment of the debt and equity will depend on several factors, including the risk profile of the revenue that will be pledged to investors, the relative rates of return required by potential investors

TABLE B-1: CAPITAL AND LIFE CYCLE COST ESTIMATES FOR HYPOTHETICAL EXPRESS LANES PROJECT

$000	TOTAL	0 2016	1 2017	2 2018	3 2019	4 2020	5 2021	6 2022	7 2023	8 2024	9 2025	10 2026	11 2027	12 2028	13 2029	14 2030	15 2031
PSC																	
Highway Design & Construction Total	$ 800,000		$ 50,000	$ 200,000	$ 250,000	$ 200,000	$ 100,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Highway Operations & Maintenance Total	$ 297,500		$ -	$ -	$ -	$ -	$ -	$ 8,500	$ 8,500	$ 8,500	$ 8,500	$ 8,500	$ 8,500	$ 8,500	$ 8,500	$ 8,500	$ 8,500
Highway Renewal & Replacement Total	$ 160,000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,500	$ -	$ 5,000	$ 30,000	$ -	$ 2,500
Highway Procurement & Agency Management Total	$ 82,450		$ 5,000	$ 20,000	$ 25,000	$ 20,000	$ 10,000	$ 70	$ 70	$ 70	$ 70	$ 70	$ 70	$ 70	$ 70	$ 70	$ 70
Total Costs (Current Dollars)	$ 1,339,950	$ -	$ 55,000	$ 220,000	$ 275,000	$ 220,000	$ 110,000	$ 8,570	$ 8,570	$ 8,570	$ 8,570	$ 11,070	$ 8,570	$ 13,570	$ 38,570	$ 8,570	$ 11,070
P3																	
Highway Design & Construction Total	$ 784,000	$ -	$ 40,000	$ 125,000	$ 240,000	$ 300,000	$ 79,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Highway Operations & Maintenance Total	$ 291,550	$ -	$ -	$ -	$ -	$ -	$ -	$ 8,330	$ 8,330	$ 8,330	$ 8,330	$ 8,330	$ 8,330	$ 8,330	$ 8,330	$ 8,330	$ 8,330
Highway Renewal & Replacement Total	$ 156,800	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,450	$ -	$ 4,900	$ 29,400	$ -	$ 2,450
Highway Procurement & Agency Management Total	$ 82,328	$ -	$ 10,000	$ 20,000	$ 25,000	$ 20,000	$ 5,000	$ 67	$ 67	$ 67	$ 67	$ 67	$ 67	$ 67	$ 67	$ 67	$ 67
Total Costs (Current Dollars)	$ 1,314,678	$ -	$ 50,000	$ 145,000	$ 265,000	$ 320,000	$ 84,000	$ 8,397	$ 8,397	$ 8,397	$ 8,397	$ 10,847	$ 8,397	$ 13,297	$ 37,797	$ 8,397	$ 10,847
INFLATION RATE	2.50%																
PSC																	
Highway Design & Construction Total	$ 864,501	$ -	$ 51,250	$ 210,125	$ 269,223	$ 220,763	$ 113,141	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Highway Operations & Maintenance Total	$ 541,449	$ -	$ -	$ -	$ -	$ -	$ -	$ 9,857	$ 10,104	$ 10,356	$ 10,615	$ 10,881	$ 11,153	$ 11,432	$ 11,717	$ 12,010	$ 12,311
Highway Renewal & Replacement Total	$ 303,280	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,200	$ -	$ 6,724	$ 41,355	$ -	$ 3,621
Highway Procurement & Agency Management Total	$ 90,909	$ -	$ 5,125	$ 21,013	$ 26,922	$ 22,076	$ 11,314	$ 81	$ 83	$ 85	$ 87	$ 90	$ 92	$ 94	$ 96	$ 99	$ 101
Total Costs (Year of Expenditive Dollars)	$ 1,800,139	$ -	$ 56,375	$ 231,138	$ 296,145	$ 242,839	$ 124,455	$ 9,939	$ 10,187	$ 10,442	$ 10,703	$ 14,171	$ 11,245	$ 18,250	$ 53,169	$ 12,109	$ 16,033
P3																	
Highway Design & Construction Total	$ 851,307	$ -	$ 41,000	$ 131,328	$ 258,454	$ 331,144	$ 89,381	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Highway Operations & Maintenance Total	$ 530,620	$ -	$ -	$ -	$ -	$ -	$ -	$ 9,660	$ 9,902	$ 10,149	$ 10,403	$ 10,663	$ 10,930	$ 11,203	$ 11,483	$ 11,770	$ 12,064
Highway Renewal & Replacement Total	$ 297,214	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,136	$ -	$ 6,590	$ 40,528	$ -	$ 3,548
Highway Procurement & Agency Management Total	$ 90,154	$ -	$ 10,250	$ 21,013	$ 26,922	$ 22,076	$ 5,657	$ 77	$ 79	$ 81	$ 83	$ 85	$ 87	$ 89	$ 92	$ 94	$ 96
Total Costs (Year of Expenditive Dollars)	$ 1,769,296	$ -	$ 51,250	$ 152,341	$ 285,376	$ 353,220	$ 95,038	$ 9,737	$ 9,981	$ 10,230	$ 10,486	$ 13,884	$ 11,017	$ 17,882	$ 52,103	$ 11,864	$ 15,709
DISCOUNT RATE	5.00%																
PSC																	
Highway Design & Construction Total	$ 742,234	$ -	$ 48,810	$ 190,590	$ 232,565	$ 181,622	$ 88,649	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Highway Operations & Maintenance Total	$ 176,023	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,356	$ 7,181	$ 7,010	$ 6,843	$ 6,680	$ 6,521	$ 6,366	$ 6,214	$ 6,066	$ 5,922
Highway Renewal & Replacement Total	$ 89,932	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,965	$ -	$ 3,744	$ 21,932	$ -	$ 1,742
Highway Procurement & Agency Management Total	$ 75,673	$ -	$ 4,881	$ 19,059	$ 23,256	$ 18,162	$ 8,865	$ 61	$ 59	$ 58	$ 56	$ 55	$ 54	$ 52	$ 51	$ 50	$ 49
Present Value Dollars	$ 1,083,862	$ -	$ 53,690	$ 209,649	$ 255,821	$ 199,784	$ 97,514	$ 7,416	$ 7,240	$ 7,067	$ 6,899	$ 8,699	$ 6,574	$ 10,162	$ 28,197	$ 6,116	$ 7,712
P3																	
Highway Design & Construction Total	$ 723,894	$ -	$ 39,048	$ 119,118	$ 223,262	$ 272,433	$ 70,033	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Highway Operations & Maintenance Total	$ 172,502	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,209	$ 7,037	$ 6,869	$ 6,706	$ 6,546	$ 6,390	$ 6,238	$ 6,090	$ 5,945	$ 5,803
Highway Renewal & Replacement Total	$ 88,133	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,925	$ -	$ 3,670	$ 21,493	$ -	$ 1,707
Highway Procurement & Agency Management Total	$ 76,049	$ -	$ 9,762	$ 19,059	$ 23,256	$ 18,162	$ 4,432	$ 58	$ 56	$ 55	$ 54	$ 52	$ 51	$ 50	$ 49	$ 47	$ 46
Present Value Dollars	$ 1,060,578	$ -	$ 48,810	$ 138,177	$ 246,519	$ 290,595	$ 74,465	$ 7,266	$ 7,093	$ 6,924	$ 6,759	$ 8,524	$ 6,441	$ 9,958	$ 27,631	$ 5,992	$ 7,556

(the "cost of capital"), and constraints imposed by potential lenders on the size and structure of the loans.

Table B2 below provides an illustrative capital structure for the P3 and PSC scenarios for the hypothetical express toll lanes project.

Table B2 - Estimated Sources and Uses of Funds

$ Millions	PSC		P3 Scenario	
TIFIA Loan	390	*33%*	395	*33%*
Debt Financing Payable from Toll Revenue	631	*53%*	674	*56%*
Private Equity	-		136	*11%*
Public Contribution (Federal, State and Local Funds)	170	*14%*	-	
Total Sources of Funding	$1,191		$1,205	
Preliminary Capital Cost Estimate	865		851	
Required Reserves and Other Eligible Costs *	326		354	
Total Uses of Funding	$1,191		$1,205	

* Includes amounts to pay interest during construction, debt issuance costs, and deposits to debt service reserves.

Key assumptions for each source of funding include:

- *TIFIA Loan* - TIFIA credit assistance for eligible surface transportation projects is available in the form of a direct loan, loan guarantee, or standby line of credit. Given the attractive borrowing cost (comparable to U.S. Treasury rates) and flexible repayment terms (repayment may be deferred, for example, up to five years after substantial completion), project sponsors typically seek TIFIA loans. Since USDOT policy is to limit the TIFIA loan amount to 33% of eligible project costs, except under extraordinary circumstances, it is common to first "maximize" the amount of TIFIA in the financial model by sizing the loan at approximately 33% of the estimated capital cost (including eligible development costs incurred by the RPE before financial close) before determining the other sources of funding.

- *Senior Debt Financing* – Repayment of the TIFIA loan can be subordinated to bonds or bank loans with a senior claim on the pledged revenue if the proposed senior debt is structured in a manner that enables it to be rated "investment grade" by two rating agencies.[3] The credit quality of the senior debt is determined in large part by the projected debt service coverage ratios ("DSCRs") in the financial model. The DSCR is the ratio of the amount of cash available to pay debt service in each year (usually the projected net revenue after payment of O&M expenses) and the amount of principal and interest scheduled to be repaid in each year.

[3] Debt is considered "investment grade" if the credit rating from Standard & Poor's or Fitch is BBB- or higher or Baa3 or higher from Moody's.

$$\textbf{Senior Debt Service Coverage Ratio (DSCR)} = \frac{\textbf{Annual Cash Flow Available for Debt Service}}{\textbf{Annual Senior Debt Service}}$$

The minimum DSCR required to obtain an investment grade rating for senior debt can vary significantly depending on the perceived project risk, particularly the risk that project revenue may be less than projected. A reasonable assumption for a new toll facility typically ranges between 1.60x to 2.00x. The minimum global DSCR for total senior and the subordinate TIFIA debt should generally range between 1.25x and 1.40x. Those minimum DSCR constraints were achieved in the financial model created for the hypothetical express lanes.

- *Private Equity* - In order to achieve the target DSCRs on the senior debt and TIFIA, it may be necessary to limit the amount of debt in the financial model. That can be achieved by funding a portion of the estimated capital costs with private equity. The return required by private equity investors will generally be much higher than the potential interest rate on senior and subordinate debt because those investors are repaid after debt service and they may incur significant losses if the revenue projections are not realized. The assumed internal rate of return ("IRR") for an equity investment should reflect the project risk profile (e.g., higher for projects with revenue risk and/or for projects with complex design and construction challenges) as well as the equity returns established in the market for comparable projects. For purposes of the hypothetical express lanes example, a target return of 12% was used. [4]

- *Public Contribution* – In scenarios where the projected revenue is not sufficient to support the total amount of financing needed to fund the estimated capital costs, it may be necessary to assume that public funding will be available. The PSC scenario for the hypothetical express lanes required $170 million of public funding, approximately 14% of the capital cost, to achieve a minimum DSCR on all debt greater than 1.25x. The P3 example does not include any public funding.

A summary of the cash flows developed for the P3 and PSC scenarios for the hypothetical express lanes project is provided in Table B3. Under the PSC, the RPE retains the toll revenue remaining after paying project costs. Discounting the value of the estimated Remaining Net Revenue (approximately $300 million) provides an order-of-magnitude estimate of the present value "cost" (approximately $86 million) in terms of potential net revenue forgone if the P3 option is selected.

The toll revenue used to size and structure the debt financing in both the PSC and P3 scenarios is typically more conservative (higher probability of occurrence) than the revenue estimate used to determine the potential return on the equity investment in the P3 scenario. The higher revenue forecast for scenarios with private equity is appropriate because equity investors have a higher risk tolerance than bondholders and lenders and they will actively manage projects to enhance revenue and reduce expenses to achieve the desired investment returns.

[4] Internal rate of return for equity was calculated before potential taxes and assumes no future debt refinancing that modifies the initial capital structure.

TABLE B-3: CASH FLOW SUMMARY FOR HYPOTHETICAL EXPRESS LANES PROJECT

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
$000	TOTAL	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
PSC																
Gross Toll Revenue	$ 3,285,745	$ -	$ -	$ -	$ -	$ -	$ 50,000	$ 55,000	$ 57,750	$ 59,483	$ 61,267	$ 63,105	$ 64,998	$ 66,948	$ 68,957	$ 71,025
less O&M Expenses before Debt	$ 545,908	-	-	-	-	-	9,939	10,187	10,442	10,703	10,970	11,245	11,526	11,814	12,109	12,412
Cash Available For Debt Service	$ 2,739,837	$ -	$ -	$ -	$ -	$ -	$ 40,061	$ 44,813	$ 47,308	$ 48,780	$ 50,297	$ 51,860	$ 53,472	$ 55,134	$ 56,847	$ 58,613
less Net Senior Debt Service and TIFIA	$ 2,135,313	-	-	-	-	-	31,222	34,925	36,870	38,017	39,199	40,418	41,674	42,969	44,304	45,681
Debt Service Coverage							1.28x	1.28x	1.28x	1.28x	1.28x	1.28x	1.28x	1.28x	1.28x	1.28x
less Renewal and Replacement Deposits	$ 303,280	-	-	-	-	-	1,280	1,985	10,256	10,256	10,340	10,340	8,995	724	2,323	2,418
Remaining Net Revenue (YOE$)	$ 301,244	$ -	$ -	$ -	$ -	$ -	$ 7,559	$ 7,903	$ 182	$ 507	$ 757	$ 1,102	$ 2,803	$ 11,441	$ 10,220	$ 10,515
P3																
Gross Toll Revenue	$ 3,778,607	$ -	$ -	$ -	$ -	$ -	$ 57,500	$ 63,250	$ 66,413	$ 68,405	$ 70,457	$ 72,571	$ 74,748	$ 76,990	$ 79,300	$ 81,679
less O&M Expenses before Debt	$ 534,856	-	-	-	-	-	9,737	9,981	10,230	10,486	10,748	11,017	11,292	11,575	11,864	12,161
Cash Available For Debt Service and Equity	$ 3,243,751	$ -	$ -	$ -	$ -	$ -	$ 47,763	$ 53,269	$ 56,182	$ 57,919	$ 59,709	$ 61,554	$ 63,455	$ 65,416	$ 67,436	$ 69,518
less Net Senior Debt Service and TIFIA	$ 2,292,783	-	-	-	-	-	33,760	37,652	39,711	40,939	42,204	43,508	44,852	46,238	47,666	49,138
Debt Service Coverage							1.41x	1.41x	1.41x	1.41x	1.41x	1.41x	1.41x	1.41x	1.41x	1.41x
less Renewal and Replacement Deposits	$ 297,214	-	-	-	-	-	1,254	1,945	10,051	10,051	10,133	10,133	8,815	710	2,276	2,370
Potential Equity Distributions (YOE$)	$ 653,754	$ -	$ -	$ -	$ -	$ -	$ 12,748	$ 13,672	$ 6,420	$ 6,929	$ 7,371	$ 7,912	$ 9,788	$ 18,468	$ 17,494	$ 18,011

DISCOUNT RATE 5.00%

PSC																
Gross Toll Revenue	$ 1,040,617	$0	$0	$0	$0	$0	$37,311	$39,087	$39,087	$38,343	$37,613	$36,896	$36,193	$35,504	$34,828	$34,164
less O&M Expenses before Debt	$ 177,472	$0	$0	$0	$0	$0	$7,416	$7,240	$7,067	$6,899	$6,735	$6,574	$6,418	$6,265	$6,116	$5,970
Cash Available For Debt Service	$ 863,145	$0	$0	$0	$0	$0	$29,894	$31,848	$32,020	$31,444	$30,878	$30,322	$29,775	$29,239	$28,712	$28,194
less Net Senior Debt Service and TIFIA	$ 672,699	$0	$0	$0	$0	$0	$23,298	$24,821	$24,955	$24,506	$24,065	$23,631	$23,206	$22,788	$22,377	$21,973
less Renewal and Replacement Deposits	$ 104,331	$0	$0	$0	$0	$0	$955	$1,411	$6,942	$6,611	$6,348	$6,046	$5,009	$384	$1,173	$1,163
Remaining Net Revenue (PV$)	$ 86,115	$0	$0	$0	$0	$0	$5,641	$5,616	$123	$327	$465	$645	$1,561	$6,067	$5,162	$5,058
P3																
Gross Toll Revenue	$ 1,196,710	$0	$0	$0	$0	$0	$42,907	$44,951	$44,951	$44,094	$43,254	$42,431	$41,622	$40,830	$40,052	$39,289
less O&M Expenses before Debt	$ 173,879	$0	$0	$0	$0	$0	$7,266	$7,093	$6,924	$6,759	$6,598	$6,441	$6,288	$6,138	$5,992	$5,849
Cash Available For Debt Service and Equity	$ 1,022,830	$0	$0	$0	$0	$0	$35,641	$37,857	$38,026	$37,335	$36,656	$35,989	$35,334	$34,691	$34,060	$33,440
less Net Senior Debt Service and TIFIA	$ 722,968	$0	$0	$0	$0	$0	$25,192	$26,759	$26,878	$26,390	$25,910	$25,438	$24,975	$24,521	$24,074	$23,636
less Renewal and Replacement Deposits	$ 102,245	$0	$0	$0	$0	$0	$936	$1,382	$6,803	$6,479	$6,221	$5,925	$4,909	$376	$1,150	$1,140
Potential Equity Distributions (PV$)	$ 197,618	$0	$0	$0	$0	$0	$9,513	$9,716	$4,345	$4,467	$4,525	$4,626	$5,450	$9,794	$8,836	$8,664

Step 3: Estimate the monetary value of major project risks

The P3 Risk Management Guidelines outline how to categorize and quantify project risks during the development, construction and operation phases of a project. At the early stages of project development, the risk analysis may be more qualitative and simply identify the types of project risks that can have a significant impact on project costs. As the project development effort advances and better data becomes available, more robust and detailed risk analyses can be conducted to quantify the value of certain risks that may be transferred under a P3 option.

To illustrate how risk-adjusted cost estimates can be developed, a conceptual proxy is used to generate an order-of-magnitude estimate of the major risks that could be transferred to, or shared with, the private sector under the P3 option for the hypothetical express lanes project: the risk that toll revenue may be significantly lower than projected and the risk that the cost to operate and maintain the facility may be higher than anticipated.

Under the P3 option, the private equity investor and subordinated lenders bear the toll revenue risk. If the actual toll revenue generated by the Project is less than forecasted, there should be no financial impact to the RPE. Under the PSC scenario, if actual toll revenue is less than forecasted, the net revenue available after payment of routine operations and maintenance expenses and scheduled debt service payments, if any, will be reduced. Depending on the magnitude of the revenue shortfall, the RPE may have to defer capital renewal and replacement work and/or fund the work from sources other than project revenue.

Under both the PSC and P3 options, there is potential upside for the RPE if actual revenue is greater than anticipated. It is relatively common, for example, to negotiate revenue-sharing provisions in P3 agreements. However, for purposes of the quantitative analysis for the VFM comparison, it is important to focus on the potential costs associated with a revenue shortfall so that decision-makers can evaluate the potential value of transferring revenue risk under a P3.

Table B4 on the next page shows the discounted value for a range of reductions to the toll revenue forecast used in the PSC scenario. For the hypothetical express lanes example, a 10% revenue reduction is used to value the revenue risk the RPE would retain if it selects the PSC delivery option at $104 million. The size of the stress test reductions that are requested by rating agencies and investors for actual transaction will vary depending on the rigor of the revenue forecast and the level of confidence in the underlying assumptions.

A similar approach is used to estimate the potential value of risk that the RPE retains under the PSC with regard to the cost of operations and maintenance exceeding projections. Table B5 shows the discounted value of a range of increases to the assumed O&M costs in the hypothetical PSC scenario. The $9 million value associated with a 10% increase is used to develop the risk-adjusted cost to the RPE that is developed in Step 4.

TABLE B-4: PROXY FOR POTENTIAL VALUE OF TOLL REVENUE RISK

$000	TOTAL	1 2017	2 2018	3 2019	4 2020	5 2021	6 2022	7 2023	8 2024	9 2025	10 2026	11 2027	12 2028	13 2029	14 2030	15 2031
PSC																
100% of Gross Toll Revenue	$ 3,285,745	$ -	$ -	$ -	$ -	$ -	$ 50,000	$ 55,000	$ 57,750	$ 59,483	$ 61,267	$ 63,105	$ 64,998	$ 66,948	$ 68,957	$ 71,025
90% of Gross Toll Revenue	$ 2,957,171	$ -	$ -	$ -	$ -	$ -	$ 45,000	$ 49,500	$ 51,975	$ 53,534	$ 55,140	$ 56,794	$ 58,498	$ 60,253	$ 62,061	$ 63,923
Reduction in Nominal Dollars	$ (328,575)	$ -	$ -	$ -	$ -	$ -	$ (5,000)	$ (5,500)	$ (5,775)	$ (5,948)	$ (6,127)	$ (6,310)	$ (6,500)	$ (6,695)	$ (6,896)	$ (7,103)
85% of Gross Toll Revenue	$ 2,792,884	$ -	$ -	$ -	$ -	$ -	$ 42,500	$ 46,750	$ 49,088	$ 50,560	$ 52,077	$ 53,639	$ 55,248	$ 56,906	$ 58,613	$ 60,371
Reduction in Nominal Dollars	$ (492,862)	$ -	$ -	$ -	$ -	$ -	$ (7,500)	$ (8,250)	$ (8,663)	$ (8,922)	$ (9,190)	$ (9,466)	$ (9,750)	$ (10,042)	$ (10,343)	$ (10,654)
75% of Gross Toll Revenue	$ 2,464,309	$ -	$ -	$ -	$ -	$ -	$ 37,500	$ 41,250	$ 43,313	$ 44,612	$ 45,950	$ 47,329	$ 48,749	$ 50,211	$ 51,717	$ 53,269
Reduction in Nominal Dollars	$ (821,436)	$ -	$ -	$ -	$ -	$ -	$ (12,500)	$ (13,750)	$ (14,438)	$ (14,871)	$ (15,317)	$ (15,776)	$ (16,250)	$ (16,737)	$ (17,239)	$ (17,756)

DISCOUNT RATE 5.00%

PSC																
PV of 100% of Gross Toll Revenue	$ 1,040,617	$0	$0	$0	$0	$0	$37,311	$39,087	$39,087	$38,343	$37,613	$36,896	$36,193	$35,504	$34,828	$34,164
PV of 90% of Gross Toll Revenue	$ 936,555	$0	$0	$0	$0	$0	$33,580	$35,179	$35,179	$34,509	$33,851	$33,207	$32,574	$31,954	$31,345	$30,748
Reduction in PV Dollars	$ (104,062)	$0	$0	$0	$0	$0	($3,731)	($3,909)	($3,909)	($3,834)	($3,761)	($3,690)	($3,619)	($3,550)	($3,483)	($3,416)
PV of 85% of Gross Toll Revenue	$ 884,524	$0	$0	$0	$0	$0	$31,714	$33,224	$33,224	$32,592	$31,971	$31,362	$30,764	$30,178	$29,604	$29,040
Reduction in PV Dollars	$ (156,093)	$0	$0	$0	$0	$0	($5,597)	($5,863)	($5,863)	($5,751)	($5,642)	($5,534)	($5,429)	($5,326)	($5,224)	($5,125)
PV of 75% of Gross Toll Revenue	$ 780,463	$0	$0	$0	$0	$0	$27,983	$29,316	$29,316	$28,757	$28,209	$27,672	$27,145	$26,628	$26,121	$25,623
Reduction in PV Dollars	$ (260,154)	$0	$0	$0	$0	$0	($9,328)	($9,772)	($9,772)	($9,586)	($9,403)	($9,224)	($9,048)	($8,876)	($8,707)	($8,541)

TABLE B-5: PROXY FOR POTENTIAL VALUE OF O&M COST RISK

$000		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
PSC	TOTAL	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
100% of Highway O&M Cost Estimates	$ 541,449	$ -	$ -	$ -	$ -	$ -	$ 9,857	$ 10,104	$ 10,356	$ 10,615	$ 10,881	$ 11,153	$ 11,432	$ 11,717	$ 12,010	$ 12,311
105% of Highway O&M Cost Estimates	$ 568,521	$ -	$ -	$ -	$ -	$ -	$ 10,350	$ 10,609	$ 10,874	$ 11,146	$ 11,425	$ 11,710	$ 12,003	$ 12,303	$ 12,611	$ 12,926
Increase in Nominal Dollars	$ 27,072	$ -	$ -	$ -	$ -	$ -	$ 493	$ 505	$ 518	$ 531	$ 544	$ 558	$ 572	$ 586	$ 601	$ 616
110% of Highway O&M Cost Estimates	$ 595,594	$ -	$ -	$ -	$ -	$ -	$ 10,843	$ 11,114	$ 11,392	$ 11,677	$ 11,969	$ 12,268	$ 12,575	$ 12,889	$ 13,211	$ 13,542
Increase in Nominal Dollars	$ 54,145	$ -	$ -	$ -	$ -	$ -	$ 986	$ 1,010	$ 1,036	$ 1,062	$ 1,088	$ 1,115	$ 1,143	$ 1,172	$ 1,201	$ 1,231
120% of Highway O&M Cost Estimates	$ 649,739	$ -	$ -	$ -	$ -	$ -	$ 11,829	$ 12,125	$ 12,428	$ 12,738	$ 13,057	$ 13,383	$ 13,718	$ 14,061	$ 14,412	$ 14,773
Increase in Nominal Dollars	$ 108,290	$ -	$ -	$ -	$ -	$ -	$ 1,971	$ 2,021	$ 2,071	$ 2,123	$ 2,176	$ 2,231	$ 2,286	$ 2,343	$ 2,402	$ 2,462

DISCOUNT RATE 5.00%

PSC																
PV of 100% of Highway O&M Cost Estimates	$ 176,023	$0	$0	$0	$0	$0	$7,356	$7,181	$7,010	$6,843	$6,680	$6,521	$6,366	$6,214	$6,066	$5,922
PV of 105% of Highway O&M Cost Estimates	$ 184,824	$0	$0	$0	$0	$0	$7,724	$7,540	$7,360	$7,185	$7,014	$6,847	$6,684	$6,525	$6,369	$6,218
Increase in PV Dollars	$ 8,801	$0	$0	$0	$0	$0	$368	$359	$350	$342	$334	$326	$318	$311	$303	$296
PV of 110% of Highway O&M Cost Estimates	$ 193,625	$0	$0	$0	$0	$0	$8,091	$7,899	$7,711	$7,527	$7,348	$7,173	$7,002	$6,835	$6,673	$6,514
Increase in PV Dollars	$ 17,602	$0	$0	$0	$0	$0	$736	$718	$701	$684	$668	$652	$637	$621	$607	$592
PV of 120% of Highway O&M Cost Estimates	$ 211,227	$0	$0	$0	$0	$0	$8,827	$8,617	$8,412	$8,211	$8,016	$7,825	$7,639	$7,457	$7,279	$7,106
Increase in PV Dollars	$ 35,205	$0	$0	$0	$0	$0	$1,471	$1,436	$1,402	$1,369	$1,336	$1,304	$1,273	$1,243	$1,213	$1,184

Step 4: Comparison of Net Present Value of the Risk-Adjusted Cost Estimates

Tables B6 below provides a comparison of the effective net present value cost of the P3 and PSC project delivery options developed for the hypothetical express lanes example using two different discount rates after adjusting for residual revenue available to the RPE under the PSC approach in this example that is forgone under the P3 scenario and the value of potential project risks retained by the RPE.

With a 5% discount rate, the potential cost reduction with the P3 approach is approximately $45 million (5.3% of the estimated cost for the PSC) after considering the conceptual adjustments for forgone residual revenue to the RPE and transferred risks.

Table B6: Summary of Quantitative Analysis for VFM Comparison with a 5% Discount Rate ($Millions)

Cost Category	P3	PSC
PV of Estimated Design and Construction Cost	724	742
PV of Potential Foregone Residual Revenue	86	-
PV of Toll Revenue Risk Adjustment	-	104
PV of O&M Cost Risk Adjustment	-	9
Total Risk-Adjusted Cost Estimate for VFM Comparison	$810	$855

Potential Value for Money *(incremental cost of PSC versus P3)*	**$45**
P3 cost reduction as % of PSC	**5.3%**