Feasibility Study Guideline for Public Private Partnership Projects

Volume I & II

By

Qingbin Cui, Deepak Sharma, Morteza Farajian, and Mauricio Perez
University of Maryland
Department of Civil and Environmental Engineering
College Park, MD 20742

And

Jay Lindly
The University of Alabama
Department of Civil, Construction, and Environmental Engineering
Tuscaloosa, AL 35487

Prepared by

UTCA

University Transportation Center for Alabama

The University of Alabama, The University of Alabama at Birmingham,
and The University of Alabama in Huntsville

UTCA Theme: Management and Safety of Transportation Systems

University Transportation Center for Alabama

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- Research Performance – conduct an ongoing program of basic and applied research, the products of which are judged by peers or other experts in the field to advance the body of knowledge in transportation; and
- Technology Transfer – ensure the availability of research results to potential users in a form that can be directly implemented, utilized, or otherwise applied.

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16. Abstract

For many state Departments of Transportation (DOTs), a shortage of transportation funds requires the agencies to combat that shortage by implementing innovative programs. Nationwide, Public Private Partnerships (PPP) in transportation projects are increasingly gaining acceptance as an alternative to the traditional approaches of project delivery and public financing. Due to the complexity of scale of PPP projects, it remains a challenging task for state DOTs to identify PPP opportunity while protecting public interest. This report presents a framework for PPP feasibility study at the early phase of project development. The financing analysis process model is developed and refined for the guideline. An Excel-based software package named P3FAST is developed and attached with the research report to facilitate the PPP feasibility study for transportation agencies. An example is discussed to demonstrate the analysis process and outcome. Three types of PPP models are compared and evaluated to achieve a feasible financing structure. The report includes two volumes: volume I research report and volume II feasibility study guideline.

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Executive Summary

Public Private Partnerships (PPP) have been used in the US since the early 1990s for developing infrastructure projects. Over the past two decades, PPP market has grown significantly and an increasing number of states are embracing the PPP approach. One of the primary reasons for increasing adoption of PPP procurement is that state Departments of Transportation (DOTs) are seeking alternative source of funding as the Highway Trust Fund shows a downward trend over the past few years. However, identifying and evaluating PPP opportunities and projects still remain a challenging task.

This research identified the Alabama PPP framework under recently passed PPP legislation – Act 2009-769. The governance structure of Alabama PPP projects are demonstrated on five aspects: organizational set-up, financing mechanism, PPP formats, user fee approach, and procurement process. Based on the PPP government framework, this research developed a PPP feasibility study procedure that includes five components, namely pre-screening checklist, debt financing test, equity financing evaluation, sensitivity analysis, and capital structure optimization. This integrated analysis framework will be able to help state DOTs:

- evaluate PPP maturity;
- identify risk factors and implementation barriers;
- determine debt capacity;
- establish minimum requirement for private equity investment;
- determine equity and public fund needs
- evaluate and compare public and private financing plans;
- optimize capital structure under uncertainty;

US 280 expansion project was analyzed as a case study to demonstrate the effectiveness of the guidelines. The analysis compared three financing plans and concluded that the project is able to generate strong cash flows for debt financing. Major findings from the analysis include

- Under public financing scenario, project revenue is able to secure $395 million debts which cover approximately 56% of project capital cost.
- Private equity investment ranges from $60 to $263 million depending on investors' risk preference.
- If ALDOT could pledge $14 million of its general budget annually to the project, the expansion project will be self-financed. This hybrid financing arrangement combines debt financing with availability payment and would create a much sounder financing plan.

Volume I

Research Report

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1 Research Problem and Methodology

1.1 Research Problem

In Alabama, growing economy and aging infrastructure require an increasing investment in transportation system improvements. Under the current highway funding mechanisms, however, Alabama Department of Transportation (ALDOT) depends largely upon federal aid and the collection of gasoline and motor fuels taxes to support new and rehabilitation projects. It is expected that ALDOT's revenue will be seriously threatened by low fuel consumption due to the introduction of hybrid and alternative fuel vehicles in recent years. Alternative means of financing must be developed to address increasing financial shortfalls in Alabama's transportation funding. It is ALDOT's recommendation and Governor Riley's call that ALDOT move towards Public-Private Partnerships (P3) whenever possible to improve roadway infrastructure (ALDOT 2000, Riley 2007a).

A Public-Private Partnership can be broadly defined as a long term agreement between public and private sectors for mutual benefit (HM Treasure 2000). This agreement seeks to involve the private sector in the nontraditional areas of a project with the risks and rewards being shared in new ways (USDOT 2004). For example, a public agency may provide right-of-way and the right to collect user fees, while a private firm provides financing, technological innovation, and on-going service. Researchers and practitioners identify many contractual arrangements as PPPs, such as: fee-based contract services; Design-Build (DB); Design-Build-Operate-Maintain (DBOM); Design-Build-Finance-Operate (DBFO); Build-Own-Operate (BOO), and long-term leases (AECOM 2005, Mallet 2008). In the United States, most partnerships require the private sector to be responsible for acquiring the majority of the necessary financing (Brown et al 2009). The United Kingdom and Australia are widely recognized as forerunners of PPPs which have been used in various sectors of facility delivery since the 1980s. As reported by the Public Private Infrastructure Advisor Facility (PPIAF) and the World Bank, PPP programs in the UK and Australia have been very successful and few PPP projects perform inefficiently or failed to meet their objectives. In the US, transportation projects such as the interstate highway system have been built based on a public-public partnership between the Federal and State governments. Adding a private partner to this mix can be challenging.

PPP projects tend to be large, complex, and expensive. They usually include a design/build component, but oftentimes include more phases, like development, continuous operation, and maintenance warranty. Employing PPP in these mega-projects has provided very positive results in term of alternative financing and project performance (KCI 2005). Especially, the use of PPP provides new revenue sources to construct larger projects that would otherwise have taken decades to complete. For example, through partnering with Mesa PDC, the New Mexico DOT widened and reconstructed 118 miles of roadway within four years, which would have required 27 years under the traditional financing and delivery approach (Abbey 2004). Earlier research also shows that economic viability and proper allocation of risk are two critical factors driving the success of each partnership (Zhang 2005). Therefore, each P3 project should be individually

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evaluated to establish trust between the agency and private sector organization. Also, a state DOT needs to develop its implementation guide to identify feasible P3 opportunities to guarantee the successful implementation of P3 projects.

1.2 Research Methodology

Feasibility guidelines were developed by adopting a systematic research approach (Figure 1-1). The first task was to conduct a literature review of the existing feasibility methods used internationally and domestically. Initial review indicated that several countries used Value for Money (VfM) and some prescreening tools were also used locally and internationally to conduct the feasibility analysis. VfM analysis was reviewed for the United Kingdom, Australia, Canada and Ireland. However Texas, Florida and Virginia have developed their own VfM analysis tools/process and hence the methods used in these states were also reviewed in detail.

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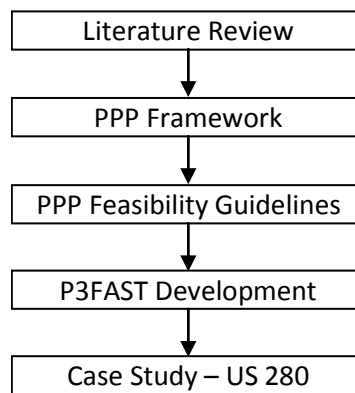
Figure 1-1 Research Methodology

The research then went on to review the PPP legislation in Alabama. The HB217 (Act#2009-769) passed in 2009 authorizes ALDOT to deliver projects using public private partnership approach. The research team conducted detailed analysis of the legislation and developed the PPP framework under the new authorization. Furthermore, PPP feasibility guidelines were developed under the legislative framework of the State. These guidelines included
  ▪ Stepwise process to conduct debt capacity analysis which helps in calculating debt available for the project;
  ▪ Stepwise process to conduct equity financing analysis which helps in estimating the private and public equity investment in the project;
  ▪ Optimally allocate the equity component between private and public sector under uncertainty.
Developing the guidelines enabled the research team to identify and establish a systematic and structured way to conduct PPP feasibility analysis. Using the inbuilt features of MS Excel, the feasibility analysis was converted to a toolkit named P3FAST which stands for P3 Feasibility Analysis Toolkit.

1.3 Structure of the Report

This report provides information about the PPP feasibility analysis. Chapter 1 consists of introduction to the research objective and the methodology. Chapter 2 provides detailed review of Value for Money analysis or similar assessment processes conducted in the US and other countries. This chapter also provides information about the PPP prescreening tools used successfully on PPP projects. Chapter 3 describes the PPP program in Alabama after the passing of HB217. Allowed PPP formats are also described. Chapter 4 addresses the core issue of conducting feasibility analysis under the PPP program of Alabama. In this chapter details about prescreening checklist, debt financing test, equity financing analysis, sensitivity, and optimization are discussed in depth. These chapters cover information about estimating project costs, revenues, debt capacity, debt service schedule, revenues under aggressive case scenario, equity capacity, private equity investment, public equity investment, optimal division of equity between private and public sectors and a brief introduction to P3FAST. Chapter 5 demonstrates the process and outcome of the PPP feasibility study. The US 280 expansion project is discussed as a case study. The last chapter presents the research summary and recommendations.

2 Review of PPP Study Methodologies

2.1 Pre-screening Tools

Recent industry trends have proven the importance of the pre-screening of PPP projects, especially after the increase in the number of PPP candidate projects. The number of candidate projects is usually beyond the limited resources of state DOTs. Pre-screening checklists can help to better allocate the available resources to projects which have a better chance of success (World Bank Toolkit for Public Private Partnerships in Highways). Due to the mentioned need, some state DOTs have already started using their own version of project pre-screening checklist (KPMG Corporate Finance, 2010); however, there are some differences among those checklists which make them not widely accepted by everyone in the industry.

In this study, a review of different pre-screening checklists has been made, and based on the results of this comparison a pre-screening checklist for P3FAST toolkit is developed. Figure 2.1 shows a comparison between the main elements of some of the available checklists for PPP projects.

Table 2.1: A comparison summary of some available PPP Pre-screening checklists

	World Bank	Virginia	LA Metro	Nossaman LLC	Florida
Does the project align with the institution's strategic objectives?	√				
Does the project meet the minimum cost requirements for PPPs?	€20 M	√			
Does PPP have potential increase in VFM compare to public comparator?	√	√	√	√	√
Is there any need for private equity / debt?				√	
Is there any opportunity for allocation of risk to private party?	√	√		√	√
Is there any time or cost saving opportunity?	√	√		√	√
Is there sufficient time to procure the project through PPP?	√				
Is there a competitive market for PPP? (market interest)	√	√		√	√
Does private company adds innovation or particular skills to the project?	√	√	√	√	
Is there public support for the PPP project?	√	√	√		
Does PPP bring new sources of revenue to the project?		√	√		√
Does project meet all Planning and Environmental Requirements Before Moving Forward?				√	√
Does PPP bring life cycle cost efficiencies?		√		√	√
Is there necessary institutional preparedness for PPP?				√	
Is project mature enough for PPP?(environmental clearance/preliminary designs/study reports)		√		√	

2.2 Value for Money (VfM) Analysis – International Experience

Public Private Partnership (PPP) framework has been widely adopted in several countries for developing infrastructure projects. PPPs are preferred over traditional procurement options due to their inherent advantages over traditional methods. Generally, governments use PPP framework seeking better solution for problems like management of risks, financial crunch, need for timely delivery of project, lack of expertise, and quality issues. Under the PPP agreement the private party takes responsibility to deal with several pre-allocated risks, and in return the government confers the private partner with a concession by virtue of which the private partner has rights to receive a predetermined share of profit. This agreement is based on several estimates of project operations and revenue generation during the operation phase. The PPP agreement gets finalized as the public sector finds that their issues will be addressed by the private partner in return of monetary benefits, and the private partner finds the agreement will allow them to make profit at a desired rate of return. Thus a typical PPP contract offers rewards for risks.

Variations in PPP programs can be observed amongst different countries of the world, but DOTs in the United States principally follows the process described above. Few countries have developed an effective analytical method to determine whether the PPP approach will be beneficial to the government or the traditional procurement method. Using such a methodology ensures that the government receives value from the invested money and is known as Value for Money (VfM) analysis. This chapter presents review of VfM analysis used in different countries.

2.2.1 United Kingdom Model

The United Kingdom's HM Treasury has extensively used Public Finance Initiatives (PFI) for developing schools, training centers, hospitals, waste treatment plants, highways, and many other kinds of projects. Statistics reveal that HM Treasury signed almost 650 projects under PFI procurement framework till February 2009 (Source: HM Treasury webpage) and have used the knowledge gained over the years to developed guidelines to compare traditional procurement options with PFI option and select the best available alternative.

▪ Analysis Outline

The Value for Money (VfM) Assessment Guidance provides guidance to the sponsoring agency to verify if the PFI option is a better procurement option when compared with traditional procurement options. The VfM assessment is divided into a 3 stage process. During Stage 1 of the assessment the sponsoring department is required to conduct qualitative and quantitative analysis at the program level. If Stage 1 assessment favors PFI then the assessment passes to the Stage 2 assessment keeping the option of using traditional procurement approach open. During the Stage 2 of assessment the sponsoring department is required to conduct a more detailed qualitative and quantitative analysis at project level considering Outline Business Case (OBC). If assessment during the first two stages of assessment finds PFI to be more suitable than traditional procurement methods then the Stage 3 of continuous assessment shall begin at procurement level following the notice of the Official Journal of the European Union (OJEU) -which is actually the tender notice- and continues up until the financial close. If VfM

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assessment finds conventional procurement better than PFI then the project is procured through conventional procurement method.

During the first two stages VfM a relative concept is used which compares potential or actual outcomes of alternative procurement options. The first two stages cover factors addressing viability, desirability and achievability. The following table provides information about the issues addressed under each factor.

Table 2.2 Factors and Issues Considered for VfM Analysis at Stage 1

Viability	Desirability	Achievability
▪ Program level objectives and outputs ▪ Soft services ▪ Operational flexibility ▪ Equity, efficiency and accountability ▪ Overall viability	▪ Risk management ▪ Innovation ▪ Contract duration & residual value ▪ Incentives and monitoring ▪ Lifecycle costs ▪ Overall desirability	▪ Market interest ▪ Other issues ▪ Overall achievability

▪ Stage 1 : Program Level Assessment

HM Treasury developed PFI Quantitative Evaluation Spreadsheet (Spreadsheet) with the purpose of providing a simple tool to the procuring authorities to assess VfM on projects under consideration. In the UK the use of this spreadsheet is mandatory for all projects at Stage 1 and Stage 2 of assessment. The inputs to the spreadsheet can be broadly classified as contract period, escalators (for capital expenditure, operating expenditure and unitary charge), discount rate, capital expenditure, operating expenditure, optimism bias, life cycle costs, transaction costs, third party income (which may result in a reduction in unitary charge), flexibility, tax, gearing, Sterling Swap rate, credit spread, bank margin, and a few indirect factors. The spreadsheet gives output in terms of Net Present Value (NPV) by comparing the PFI alternative with the conventional option. The Spreadsheet also allows varying inputs and testing sensitivity of input variables.

▪ Stage 2: Project Level Assessment

The Stage 2 assessment for VfM is carried out at the project level. Stage 2 includes qualitative and quantitative assessments, and the assessment confirms or contradicts the conclusions, arrived at during Stage 1, about using PFI approach as the best option delivering VfM. Since all projects have variations in characteristics, not all the projects under the VfM generating program will generate VfM. Stage 2 assessment is conducted by the project team and the team gives feedback to the sponsoring department to identify all those projects that do not generate VfM when PFI is considered as the procurement option.

The Stage 2 qualitative assessment is also conducted by the Local Authority by answering the questions related to viability, desirability, and achievability. Although many of the questions are similar to Stage 1 qualitative assessment, the level of analysis for Stage 2 qualitative assessment is much deeper when compared to Stage 1 assessment. Moreover the stage 2 assessment requires that the Local Authority focuses on all the merits of transferring or not transferring the soft services to the contractor.

The quantitative assessment at Stage 2 requires the project team to revisit the Spreadsheet and assess the PFI project again by using project specific characteristics and past experiences from similar projects. Since the Spreadsheet used during Stage 2 is the same Spreadsheet used during Stage 1 assessment the project team needs to bear in mind about the importance to attain a particular level of accuracy during Stage 2 assessment.

- Stage 3: Procurement Level Assessment

The Stage 3 assessment is conducted by the sponsoring department. It involves series of continuous checks to ensure VfM from the project and ends with the financial close. These checks are related to quality of competition, risk sharing, stability of costs, financial flexibility, financial structure, and contractor distress.

It is recommended that before reaching any conclusions from the results of the quantitative model a sensitivity analysis should be conducted by the procuring authorities. The sensitivity analysis can be conducted by using the indifference points feature of the spreadsheet. It is recommended that the user organization defines its tolerances ranges within which indifference points can be considered as acceptable. The guidelines recommend that if the level of uncertainties is high and/or if the outputs are extremely sensitive to the input variables then the decision makers should also consider qualitative assessment before reaching to a judgment.

2.2.2 Australia' Public Sector Comparator Method

Partnerships Victoria is a policy introduced by the State Government of Victoria to provide a framework for government approach towards provision of infrastructure and ancillary services through public private partnerships (source - Partnerships Victoria Homepage). For all the projects likely to deliver value for money while using public private partnership as project delivery option, it is necessary to construct Public Sector Comparator (PSC) to test whether a private investment proposal offers value for money in comparison with the most efficient form of public procurement. This report describes the method of construction, valuing and use of PSC (which includes identifying PSC Reference Project) to ascertain value for money while using PPP option of project delivery.

The PSC estimates the hypothetical risk-adjusted costs (Kerali) of the project assuming that the project is to be financed, owned and implemented by government. To construct a PSC the output specifications of the project, risk allocation as reflected in the contract, and most efficient form and means of government delivery are identified. This identification of the most likely and efficient form of public sector delivery that could be employed to satisfy all elements of the output specifications based on current best practices is called the PSC Reference Project. This is followed by valuing the four core elements of the PSC and adding them together as shown below

$$\boxed{\textbf{PSC} = \textbf{Raw PSC} + \textbf{Competitive Neutrality} + \textbf{Transferable Risks} + \textbf{Retained Risks}}$$

The Raw PSC element of the PSC provides a base costing under the public procurement method and includes all capital and operating costs (both direct and indirect) associated with building, owning, maintaining and delivering the service. Using Competitive Neutrality in the PSC

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removes any net competitive advantages that accrue to the government by virtue of its public ownership like land tax exemption, local government rates exemption, stamp duty exemption, and several others. The Transferable Risks element is included in PSC to include all those risks that are initially with the government but are transferred to the private sector which can better manage those risks. The Retained Risks element of the PSC includes all those risks or parts of risks that the government proposes to bear itself under the PPP project. The guide provides the steps to quantify risks and also provides list of methods that can be used for this purpose. The PSC quantitatively assess the projects.
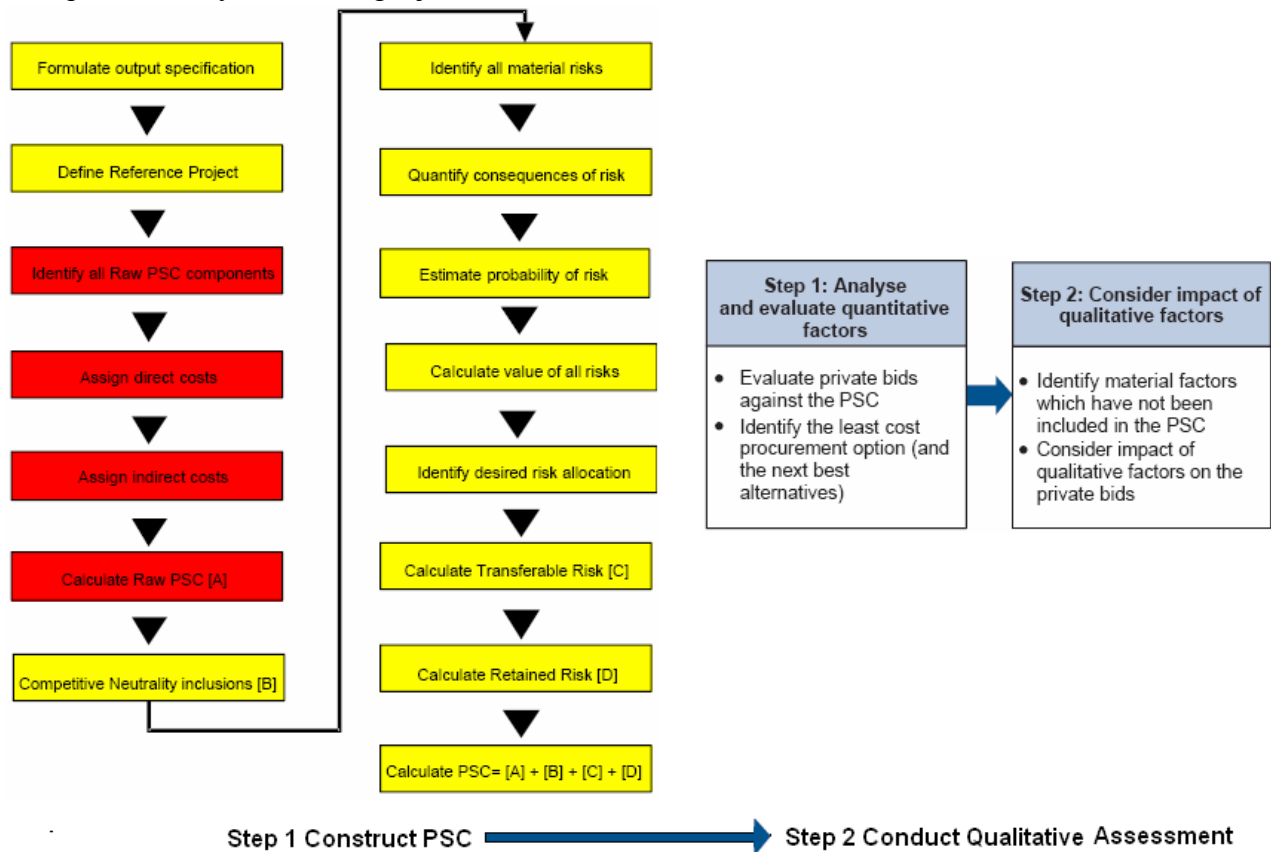
Figure 2.1 Flow Chart of Value for Money Assessment

After quantitative assessment using PSC the next step is to qualitatively assess the options. The qualitative assessment requires that the public sector subjectively assesses all the factors that cannot be quantified. Some of the elements that can be considered are material costs including risks which cannot be quantified, bidder qualification, differences in deliverable services that cannot be quantified, accounting long term and short term social benefits, and the reasonableness of assumptions made while developing the PSC. The whole process can be represented using the figure 2 shown above (source Public Sector Comparator a Technical Note (2001));

2.2.4 Ireland's PPP Guidelines

Ireland government has used PPP procurement approach on more than 70 projects (out of these a few of them are under review). Ireland has formed a Central Unit in Department of Finance to facilitate the PPP process centrally. This Central Unit is responsible for developing the general

policy framework for PPPs and providing central guidance to Departments and other State Authorities. The Central Unit is divided into two key groups namely Inter Departmental Group (IDG) and Public/Private Informal Advisory Group (IAG). The IDG brings together all the key decision makers to ensure that there is coherence and consistency across the public service sectors in developing PPPs while the IAG includes representatives of employers' organizations, the Trade Union Congress, and the construction and engineering sectors. Under this setup Ireland's government has developed a set of guidelines named "Assessment of Projects for Procurement as Public Private Partnership" which provides pointers to conduct an assessment to establish if the PPP approach would be appropriate for project delivery.

The guidelines require that the State Government seeks answers to three broad questions while assessing the possibility of adopting Public Private Partnership (PPPs) as one of the possible procurement route for projects costing over € 20 million. These questions are focused on Sponsoring Agency's power and/or resources to enter PPPs, viability of PPP arrangement as one of the procurement options, and the most appropriate form of PPP arrangement for the project in hand. Ireland's guidelines divide these questions in three different sections and the elements of these sections are summarized in the following table.

Table 2.3 Elements Considered for VfM Analysis in Ireland

Section 1 Assessment	Section 2 Assessment	Section 3 Assessment
▪ Vires ▪ Affordability ▪ Sustainability	▪ Scale of project ▪ Significant service ▪ User Charge ▪ PPP Market in Sector ▪ Stability of Future Demand ▪ Output Specifications ▪ Risk Transfer ▪ Employee Relationships	▪ Procurement options ▪ Use of private finance ▪ Elements in a PPP

2.2.5 Canada's PPP Assessment Guidelines

During the review process it was learned that some provinces in Canada have used PPPs for delivering public projects. Attempts were made to obtain guidelines for preparing Public Sector Comparator for conducting value for money assessment, but the guidelines were not available. Hence 2 project reports were identified that had some information about Public Sector Comparators. Each of these projects was in one of three different provinces in Canada which offered the opportunity to study (at a bird's eye level) the differences and similarities between the Public Sector Comparators from different provinces of the same country. The three projects were in Quebec, Ontario, and British Columbia. Due to the unavailability of PSC construction guidelines the study of the public sector comparators was limited to identification of elements and sub elements used for constructing PSC.

▪   Autoroute 25 Project

As per the "Value for Money Report" the PSC for Autoroute 25 project included qualitative and quantitative assessments. The elements considered for quantitative assessment are design-

construction cost, and operation and maintenance costs. Other Relevant Cost Elements include toll revenue as per forecasts, risks that are expected to be transferred (list of risk considered can be obtained from the original report), and residual value of assets. The elements considered for qualitative assessment are as follows:

➢ Restriction of Ministry's role to supervision only
➢ Allowing Ministry intervention in case of failure to achieve performance requirements
➢ Involvement of world class finance lenders would monitor the project closely to protect their money
➢ Project can be delivered early representing socio-economic benefits to the society
➢ If the traditional procurement used on the project it can extend the project duration beyond the expected because of reasons associated with allocation of budget
➢ Maintenance and rehabilitation of the project would benefit because of partnership agreement between the private partner and the ministry. This would generate benefits since maintenance and rehabilitation may only be carried out under a traditional procurement method if the budget is available
➢ Profit sharing clause which is designed such that remittance of toll above the expected forecast of tolls in equal proportion

▪ Montfort Hospital Expansion and Redevelopment Project

The Government of Ontario approved a budget of 30 billion plus for infrastructure projects. The projects which fall under the partnerships framework are assigned to Infrastructure Ontario and the partnerships framework in Ontario is named Alternative Financing and Procurement (AFP).

The Montfort Hospital Expansion and Redevelopment Project a project for which using AFP framework was considered beneficial. Value for Money assessment of this project (from the report "Making Project Happen") indicates that the AFP option for the project would give a value of $19.4 million which is about 8.10% cost savings to the public sector. Quantitative value for money analysis was conducted using PSC which included the following elements include base project costs, cost of retained risks, and ancillary costs. The base project costs are construction and financing costs. The cost of retained risks covers all cost of design risks, construction cost overrun risk, and schedule delay risk. Ancillary costs are soft costs and include legal and management fees. The analysis is qualitative in essence and does not include a quantitative component.

2.3 Value for Money (VfM) Analysis – US Experience

2.3.1 Texas DOT

Texas Department of Transportation (TxDOT) has developed MS Excel based Public-Private Partnership (PPP) feasibility toolkit model named as TxDOT Public-Private Feasibility Analysis Model. The toolkit is developed to consider different types of ground transportation projects like rail relocation, passenger rail service, toll roads, and several others. The toolkit is developed by recognizing the fact that each transportation project redistributes the traffic in the corridor. The toolkit requires that the user inputs data according to the type of project, and once the data are fed in the spreadsheet model, the results of the analysis are obtained in the form of several graphs and benefits from the project like reduction in impedance of traffic due to the new project. The

toolkit model is developed such that if multiple private partners are associated with the project then the user can add a spreadsheet to incorporate the project features from the additional private partner.

The toolkit model consists of total seven worksheets, namely Public, Private, GC Data (GC stands for Grade Crossing), Public Plot, Joint Plot, Public CF Plot, Traffic Plot. The Public, Private, and GC Data spreadsheets of the toolkit are designed to input data while the rest of them give various plots which helps the user to interpret the feasibility of the public private partnership project. Each spread sheet is elaborated briefly below.

The Public worksheet consists of four parts as shown in the figure below and they all helps the user to evaluate the costs and benefits from the project to the public agency, society or the user segment of the public sector. Part A of the spreadsheet consists of input tables for vehicle unit costs and benefits, passenger unit costs and benefits, and annual costs and benefits. Part B allows for the entry of data related to vehicle emission costs, vehicle operating costs, and total vehicle impedance costs. Part C allows entry of project economic parameters, cost allocation schedule, operating schedule, and grade crossing impedance options and the Part D of the spreadsheet summarizes the data input in the earlier parts and provides the user with pro forma statement, economic analysis results and concession fees paid by the private sector. The Part D also allows the user to input four different discount rates in the model.

The Private spreadsheet consists of three parts, as shown below, and all the parts collectively help the user to evaluate the costs and benefits from the project to the private sector. The Part A of the spreadsheet consists of input tables for vehicle unit costs and benefits, passenger unit costs and benefits, freight rail annual operating costs, passenger rail annual operating costs, passenger rail annual operating costs, and other annual costs and revenue. Part B allows for the entry of data related to project economic parameters, cost allocation schedule, operating schedule and schedule of concession payments, and Part C of the spreadsheet summarizes all the data input in the earlier parts of this spreadsheet and provides a pro forma statement and economic analysis results. Part C also allows the user to input four different discount rates in the model.

The GC Data consists of four parts, as shown below, and allows the user to input information about the costs or benefits from the changes to the grade crossings associated with the project. Part A of this spreadsheet consists of input tables for freight rail operating conditions and freight rail train schedule. Part B allows users to enter data related passenger rail operating conditions, and passenger rail train schedule. Part C of the spreadsheet enables the user to input data related to roadway traffic patterns, in-place grade crossings, and proposed grade separations. The last part of the spreadsheet, Part D, summarizes the impedance conditions.

The Public Plot Spreadsheet provides plots between NPV versus discount rate for agency, society, and the users. The plots provide information regarding feasibility of the project from the public sector perspective at an acceptable discount rate.

The Joint Plot spreadsheet provides plots of agency economics and corporate economics in terms of NPV and discount rate. This plot enables the user to estimate the internal rate of return to the private sector. The Public CF Plot provides information about the annual cash flow for the

11

agency. The Traffic Plots provide information about the vehicular & passenger rail traffic volume projections of the concession period.

2.3.2 Virginia DOT

The Public Private Partnership Act (PPTA) of 1995 enables the Commonwealth of Virginia and other public bodies to enter partnerships with private companies to develop and or operate transportation assets which include highways, rails, airports, ports, and other transportation agencies. The PPTA allows solicited and unsolicited proposals for Commonwealth project development. Both the proposals are evaluated, selected and implemented in almost the similar ways. The Department also has the right to issue requests for information (RFI) for infrastructure projects. If RFI are issued the issuance of solicitation for proposal (SFP) are not required for the same project. The Office of the Secretary of Transportation has the responsibility to approve or reject the proposals, and if a project is approved then it allows the Department to proceed further. Basically the proposal passes through a Two-Part Process. Part One - the Conceptual Process - seeks information in five different areas of the project which are described below.

Table 2.4 Solicited and Unsolicited Proposal Evaluation Criteria

Qualification & Experience	Project Characteristics	Project Financing	Project Support	Project Benefit & Compatibility
▪ Experience with similar projects ▪ Past Performance ▪ Ability to perform ▪ Leadership ▪ PM's Experience ▪ Management Approach ▪ Project Ownership ▪ Participation of small businesses, women owned businesses & minorities and local firms ▪ Safety Record ▪ Liability	▪ Project Definition ▪ Project Schedule ▪ Operation ▪ Technology ▪ Conformity with law, regulations & standards ▪ Federal Permits & Oversight ▪ Meeting Environment Standards ▪ Federal, State & Local permits & approvals ▪ Right of Way ▪ Maintenance	▪ Financing ▪ Financial Plan ▪ Estimated Cost ▪ Life Cycle Cost Analysis ▪ Concessions	▪ Community benefits ▪ Community support ▪ Public involvement strategy	▪ Compatibility with existing system ▪ Meet policies & goals ▪ Enhancement of transport system ▪ Address local, regional state transportation needs ▪ Land use impact ▪ Economical development

The unsolicited proposals may be allowed for modification or amendment in order to meet the Department priorities. When an unsolicited proposal is received the department can also invite others to submit competing proposals. After the competing period (for unsolicited proposals) or after the close of the period (for solicited proposals), the department carries out a six phased proposal submission and review process. This process is briefly described below.

▪ Phase 1 – Quality Control (timeline of 5 to 6 months):

In this evaluation phase the Department determines whether the project proposal addresses local, regional, or state transportation plan; identifies the public needs which are not satisfied; delivers the facility timely, efficiently, or economically, and enables cost and/or risk sharing with private

entities. If the proposals pass this review phase the Department forwards the proposals to the Secretary of Transportation.

- Phase 2 – Independent Review Panel (timeline of 5 to 8 months):

The secretary of Transportation appoints and designates a Chair for the Independent Review Panel (IRP). The IRP evaluates the proposals and makes recommendation to the Department or the Oversight Board which will be the Commonwealth Transportation Board (CTB) for Virginia Department of Transportation (VDOT). During the evaluation process the IRP considers issues like – the completeness of proposals, the capability and qualification of team, the technical feasibility of conceptual plan, and the financial plan of the private party. The IRP also looks into comments from affected jurisdiction, public comments, and advice from financial and legal experts of the Oversight Board. Based on the findings the IPR provides recommendations for addressing specific issues in the detailed proposal and recommendations for policy, program, financial, or project development to help successfully implement the proposed improvements.

- Phase 3 – Oversight Board Recommendation (timeline of 2 months)

Based on the recommendations of IRP the Oversight Board recommends or rejects the advancement of the proposal to submit detailed proposals which ask the private parties to address specific issues (if any). The Oversight Board also recommends changes to the proposal itself, or any substantive or procedural changes that the Department or the Oversight Board can affect.

- Phase 4 – Submission and Selection of Detailed Proposals (timeline of 8 to 14 months)

In this phase of evaluation the detailed proposals submitted by the parties are evaluated by the Department. During the evaluation the Department makes sure that the detailed proposals meet the selection criteria and also ensures that negotiations will serve the public interests. The Department is authorized to select one or more detailed proposals for advancement of the proposal to competitive negotiations stage. Under several circumstances the Department also has the authority to proceed directly from the Oversight Board recommendation to the negotiations phase.

- Phase 5 – Negotiations (timeline of 2 to 6 months)

During the negotiations phase the Department aims to outline the rights and obligations of the parties, set a maximum rate of return for the private entity, determine liability, and establish dates for termination of the private entity's authority and thus transfer of facility to the Commonwealth.

- Phase 6 – Comprehensive Agreement (timeline of 1 month)

During this phase the draft language of the contract is forwarded to the Office of the Attorney General (AOG) for review and approval. Under the PPTA the Department Administrator has the authority to enter into partnership with the private agency. The comprehensive agreement must be signed using the procurement type approved by the Secretary of Transportation.

2.3.3 Florida DOT

In the year 2007 Florida Department of Transportation (FDOT) conducted a Value for Money Analysis for I-595 Corridor Roadway Improvement Project. FDOT realized that the project can be completed 15 years ahead of time if the different phases of the project are bundled together.

However, in doing so, the FDOT required additional funds which could be arranged if alternative financing was adopted. Hence FDOT conducted a VfM analysis to aid FDOT in making a selection between the Design Build Finance, Design Build Finance Operate, and Maintain procurement routes.

The VfM analysis was focused to carry out quantitative assessment and used several inputs including preliminary cost estimates. The VfM enabled comparison between the projected costs for offering a concession with the costs of DBF PPP contract. This was achieved by calculating FDOT's payment towards the project as investment in the project, debt service costs, construction oversight, O&M costs, insurance, and capital renewal and replacement costs. These payments were then discounted back to the analysis period. This enabled FDOT to calculate the payment for both the options. Since the concession alternative included yearly cash flows, simulation was used to develop financial statements of the concession model. Use of simulation enabled FDOT to develop a base case scenario and one another scenario which used shadow toll payments in lieu of availability payments. This procedure helped FDOT to establish that the NPV of the DBF alternative exceeded that of a concession alternative. This result was checked by conducting sensitivity analysis by varying discount rates, interest rates, risk adjustments, overrun factors, competitive interest, debt structure, cost estimates, IRR requirements, and traffic and revenue forecasts.

Apart from this FDOT also analyzed several non-quantifiable factors to conclude that the concession PPP was better than the DBF.
1. Alignment of interest of concessionaire and the public agency
2. Achieving efficiency by transferring life cycle costs and long term O&M responsibilities
3. Retaining responsibilities with the public sector and effect on public acceptance
4. Expansion of highway network in the future
5. Retaining responsibilities of toll management
6. Considering long term plans for the corridor.

2.3 Discussion on Value for Money Analysis

The Value for Money analysis has been used extensively for the assessment of projects. This valuable analysis enables the decision makers to identify the potential cost reductions on projects when procured as a PPP project and also helps the authorities to transfer or retain project risks. This assessment has been in use as the basic framework for decades in several countries. In the United States, barring a few, the majority of states have used similar assessment framework and have expressed satisfaction with the process (Morallos 2009). However the VfM analysis has its own limitations/drawbacks and has been criticized for multiple reasons (Blair Mackay Mynett Inc (2009), Murray (2006), Partnerships Victoria (2006)). These limitations/drawbacks affect the accuracy of results which the research team believes is due to the assumptions in the analysis.

The current VfM analysis requires estimation of reduction in costs when a project is delivered through partnerships compared to the costs of delivering the project through traditional procurement. This estimation is done by focusing only on the costs and considering all other factors to be same along the two procurement routes. This introduces an assumption that the project will generate equal benefits whether the project is delivered through partnerships or as traditional projects. However review of several projects shows that the benefits to private sector

arising through a partnership can be quite different from the benefits arising through traditional procurement. The private sector may benefit from adopting aggressive strategies, increasing toll rates, achieving higher external to external traffic, achieving increase in percentage of trucks, having ease and speed of adopting measures to operate a project smoothly, or successfully generating higher benefits from their mainstream businesses (like better customer service by laying electricity cables, telephone lines, internet cables, etc). The current VfM analysis does not consider these differences in benefits along the two procurement routes.

The second inherent source of inaccuracies is the risk pricing. The VfM analysis is a risk based evaluation which requires the decision maker to identify all the risks and estimate the dollar value of those risks. With this information the decision maker identifies the risks which can be better managed by the private sector and are then transferred to the private sector. However in this process the analyst has to estimate the cost of transferring and retaining risks. This estimation requires answering the questions like, "What can go wrong?" And "What will it cost if something goes wrong?" Answering these questions accurately is very complicated, costly, time consuming, and based on many assumptions. In absence of powerful and simple methods to price risks the VfM analysis may not always provide reliable results.

Lastly the VfM analysis requires development of a public sector comparator (PSC) which is a hypothetical case considering the public sector fully developing the project. When a PSC is developed the design build procurement route is considered. However, the private sector costs may be based on other PPP formats like design build finance operate or design build, operate, maintain or some other similar PPP format. Thus the comparison of PSC with the PPP alternative may not allow apples to apples comparison of the procurement routes and therefore may lead to inaccurate results.

3 PPP Framework in Alabama

3.1 PPP Program Framework

The House Bill 217 marks the beginning of Public Private Partnerships in the State of Alabama. The Alabama House and Senate approved the HB217 in May 2009, and it is recognized as Act #2009-769. This bill establishes the PPP program in the Alabama enabling the Alabama Department of Transportation to form a partnership with private parties while developing toll roads, bridges, causeway, tunnels, or other transportation facilities. Figure 3.1 presents the PPP framework in Alabama. This law establishes a new body equivalent to a government body and provides several powers to this body and Alabama Department of Transportation (ALDOT) to develop infrastructure using partnerships.
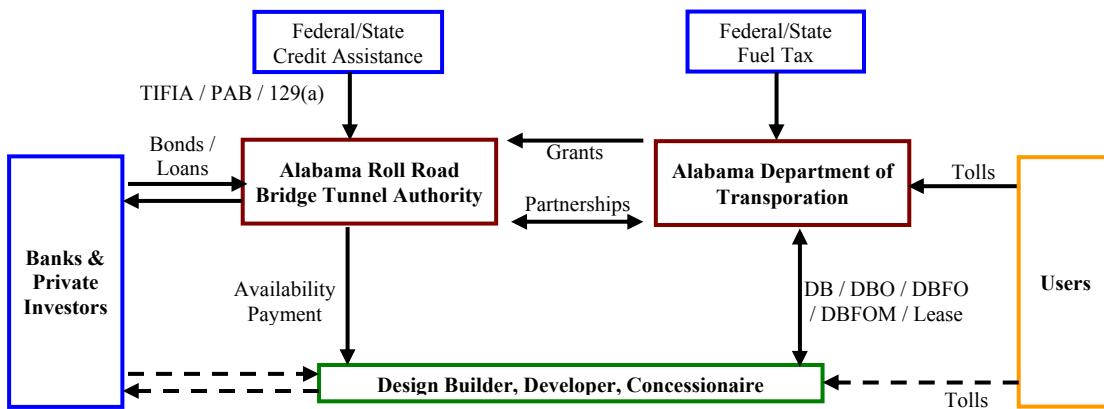
Figure 3.1 PPP Framework In Alabama

- *Organizational Set-Up*

The Act# 2009-769 establishes an authority named "Alabama Toll Road, Bridge and Tunnel Authority" (ATRBTA) consisting of a well defined organizational structure. Five members of the organization forms a quorum and these members can take decisions if it is acceptable to the majority. ATRBTA is allocated several powers and responsibilities by this law some of which are also allocated to ALDOT. However, the primary responsibility of administration and management of planning, construction, and operation of the project using partnerships is allocated only to ALDOT. ATRBTA and ALDOT can manage the tolls on highway infrastructure which includes fixing, revising, charging, and collecting the tolls from the users. ATRBTA is allowed to accept funds, grants, Federal credit assistance, borrow debt or permit private equity investment in the projects. ATRBTA can use the user revenues or any other forms of revenue or grants to repay the debt.

- *Financing Mechanism*

The newly established PPP program in Alabama provides relatively more responsibilities and mechanisms to ARTBTA for financing the projects. It authorizes ARTBTA to accept financial aids from Federal, state, local government bodies and ALDOT, take Federal credit assistance (TIFIA funds), issue bonds having maturity up to 75 years or issue notes, interim receipts or

temporary bonds, borrow debts from financial institutions and banks, and to allow private equity investment in public projects by signing partnership contracts. ATRBTA is solely responsible for paying to the owners or operators of the project using availability payment, pass-through tolls or other similar payments methods. ATRBTA is authorized to use the financial aids from Federal, state, local government bodies and ALDOT to repay bonds, costs or expenses of the project. Amongst these powers and responsibilities ALDOT has equal powers to enter partnerships for developing projects.

- *PPP Formats*

Partnerships like Design-Build (DB), Design-Build-Finance (DBF), Design-Build-Finance-Operate (DBFO), long term lease for existing tolled projects and other similar partnerships can now be used in Alabama. ALDOT and ARTBTA shares different sets of powers and authorities under each contract type.

- *User Fee Approach*

PPP framework in Alabama authorizes ALDOT and ATRBTA to raise revenue in several ways. ALDOT and ATRBTA can fix, revise, charge, and collect tolls for the public. These bodies can also lease the facility which enables them to receive upfront fee. However in several partnerships the private partner is authorized to collect tolls. Similarly, ATRBTA and ALDOT also has the authority to fix, revise, charge and collect tolls from the parties for using the transportation facility for purposes like placing telephone, telegraph, electric lights, power lines, or laying pipelines for gas and water. Collection of tolls/revenues from these entities is exempt from any kind of supervision or control by any other commission, board, bureau or agency of the State. ALDOT and ATRBTA can also generate revenue by providing leases, licenses, franchises, or concessions to private parties. The framework allows local and state government bodies to lease lend, grant or convey public property to ATRBTA to help it develop the project smoothly. Lastly, ATRBTA is responsible for payments to the private partners through availability payment, shadow tolls, pass through toll method or other similar payment mechanisms. ATRBTA can utilize revenues from all the sources combined with grants/management reserve funds from ALDOT to pay the private partners.

- *Procurement Process*

The PPP program also defines the bidding and award process for solicited projects. It requires that ALDOT and ATRBTA invite bids for a candidate project and publicly open them at a predetermined time and place. The process requires that the lowest responsible bidder be identified and awarded the contract. However the best value approach can also be adopted if the authorities find that the best value approach will serve the best interests of the state.

3.2 PPP Formats

Partnerships like Design-Build (DB), Design-Build-Finance (DBF), Design-Build-Finance-Operate (DBFO), long term lease for existing tolled projects and other similar partnerships can now be used in Alabama. Various PPP alternatives used internationally are shown using the following Figure 3.2. ALDOT and ARTBTA shares different sets of powers and authorities under each contract type. These sharing of powers and authorities can be understood through the following figures.
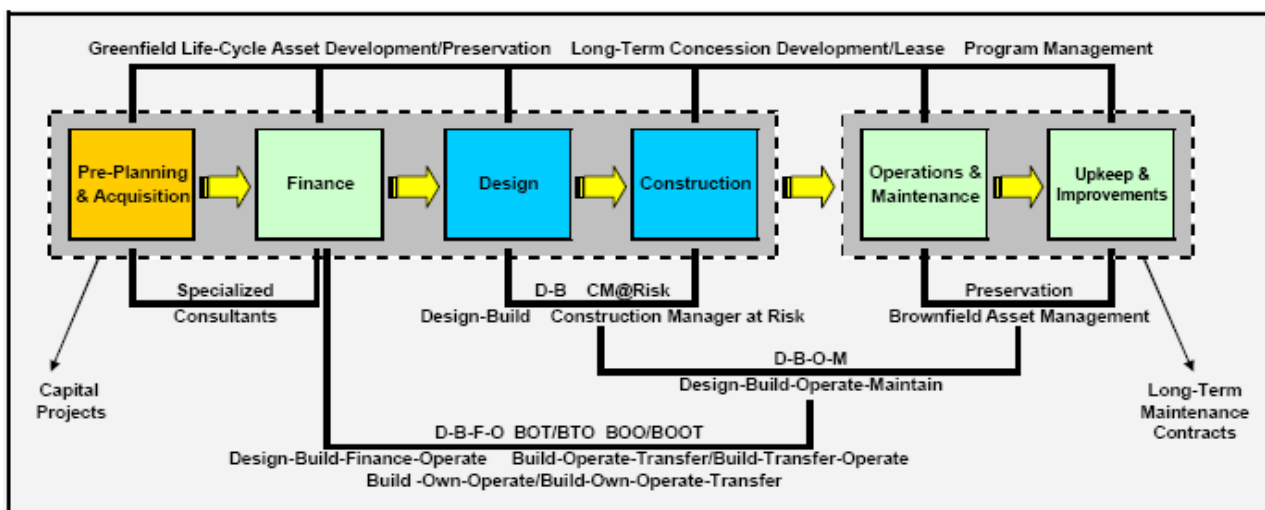
Figure 3.2 Different PPP Formats (Pakkala, 2002)

▪ *Design Build*

Design Build project delivery is the simplest PPP format. This procurement will involve the private sector early into the project which will allow them to use innovation and work simultaneously on design and construction of the project increasing the overall project efficiency. To develop this partnership ALDOT (or ATRBTA or in other words the sponsors) has to sign a single contract with a private party for designing and building the project. Under this procurement ALDOT retains the ownership of the project at all times and ATRBTA will be solely responsible for arranging adequate finance through funds, grants, or debt to pay a fixed fee to the private party or to reimburse the expenses incurred by ALDOT towards the project. ALDOT (and ATRBTA) can fix, revise, charge, and collect user tolls. For example consider the Inter County Connector (ICC) project in Maryland which is a design build project and financed totally by public funds (and debts). Further this facility is proposed to be maintained and operated by the public sector. The public sector plans to recover project finances by levying tolls to the facility users. This model can also be adopted in the state of Alabama by the virtue of this law. When using the DB model to form a PPP the project responsibilities and authorities can be shared as shown below in the figure 3.3.

	Feasibility	Plan	Finance	Design	Build	Operate	Maintain	Own
				PRIVATE PARTNER				
ALDOT	✓	✓		Contractual Agreement		✓	✓	✓
ATRBTA			✓	Contractual Agreement				
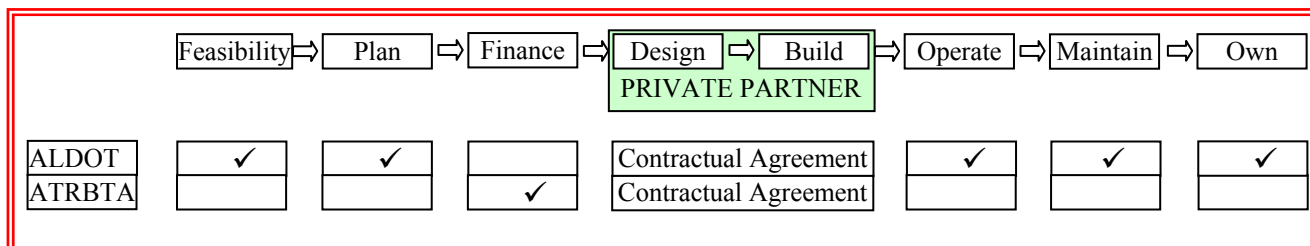
Figure 3.3 Responsibilities and Authorities For A Typical Design Build (DB) Contract In Alabama

▪ *Design Build Finance Operate*

The Design Build Finance Operate (DBFO) contract transfers the responsibilities of designing, building, financing, and operating to the private sector. However, in some cases the financing option may not be used which forms a different form of partnership known as Design Build Operate (DBO). In the U.S. many variations of DBFO model have been used, but this guideline includes only one of them. Under the DBFO model ALDOT will be the owner of the project at all times and will transfer the responsibility of financing, designing, building and operating to the private sector. Depending on the private sector investment in the project ALDOT may allow collection of revenues to the private sector. On the other hand it can pass on the responsibility of payment to ATRBTA. In the later case ATRBTA pays the private sector a fixed fee or pays using methods like availability payment or shadow tolls. Several projects in the U.S. have used this model some of them are the Dulles Greenway, the I-495 Capital Beltway HOT Lanes, the South Bay Expressway, and several others. If the DBFO model is used in Alabama one of the models may transfer the responsibilities and authorities as shown below.
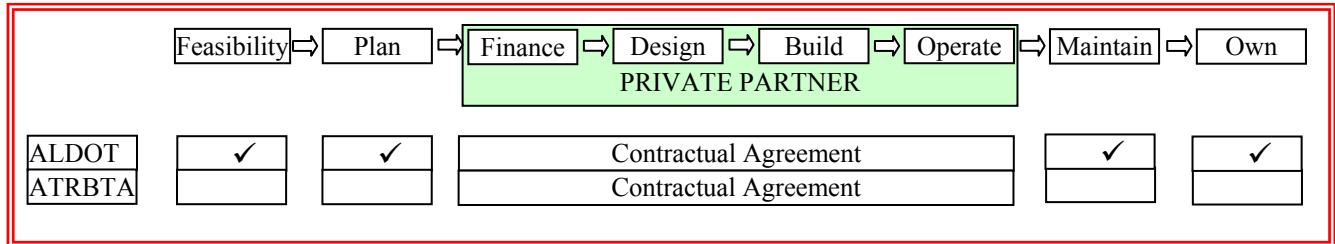
Figure 3.4 Responsibilities and Authorities For A Typical Design Build Finance Operate (DBFO) Contract In Alabama

▪ *Long Term Lease*

The PPP framework allows the award of long term lease to the private sector for existing tolled structures. The private sector that gets the lease has the right to collect tolls, but it is also responsible for operating and maintaining the facility. The private party is selected on a competitive basis however the amount of the upfront concession fee offered by the private party is the most important factor. This format of PPP has been used on the Chicago Skyway Project and the Indiana Toll Road Project.

▪ *Availability payment*
Availability is a payment to the private sector for performance of the facility irrespective of the demand (Dochia & Parker, 2009). Hence if the structure is available for use the private sector gets paid. PPPs with availability payment option do not require tolling. The private sector is paid by the public sector on the basis "pure availability" or "constructive availability." Pure availability requires the asset or part of asset to be open, functioning, unobstructed. It also requires constructive availability which includes factors like meeting performance, safety, and quality criteria specified in the contract apart from the factors considered in pure availability requirements. The price of the availability payment is fixed during procurement on the basis of bid of amounts charged by the private sector for providing 100% availability. If such a model is

used in Alabama, the authority and responsibility will be shared between ALDOT and ATRBTA depending on the type of PPP, but the payment responsibility will fall on ATRBTA. Availability payment has been used in the state of Florida for the I-595 project.

- *Private Contract Fee Service*

Private Contract Fee Service is another approach by which the public sector transfers their program risks to the private sector. This can be further divided as "Integrated Financial and Program Management" and "Developing Program Management." Under the first type of PPP the focus remains on financial management, engineering, construction, information management, and reduction of implementation periods. On the other hand Developing Capital Programs focuses on the estimation and phasing of physical improvements aimed to maximize revenue streams. The Louisiana TIMED program and the South Carolina 27 in 7 Bridge project have used these approaches.

Note: The Build-Own-Operate and its variants are perceived as not satisfying public interests because the public sector loses its control of preserving the asset and pricing the user (FHWA 2007). Moreover at the end of concession period the private sector transfers the asset to the public sector for which the public sector has to pay a predetermined fee. Therefore, extreme care must be taken when selecting a PPP model.

3.3 Other Issues

As per the PPP program ALDOT is authorized to expend funds from any available source for conducting studies, paying financing charges, or any paying off any other similar transaction charges. ALDOT must maintain records of all the transaction charges towards the project and get them reimbursed by ATRBTA.

4 PPP Feasibility Analysis

4.1 ALDOT PPP Feasibility Study Tool

Based on the framework defined by the PPP legislation and review of existing feasibility study processes, programs, and projects a process model was developed and refined for the guidelines presented in this paper. Explanation and descriptions for each step were gathered from PPP analysis reports and were combined with the Alabama PPP framework. Figure 2 presents a generalized flowchart with six analysis modules.
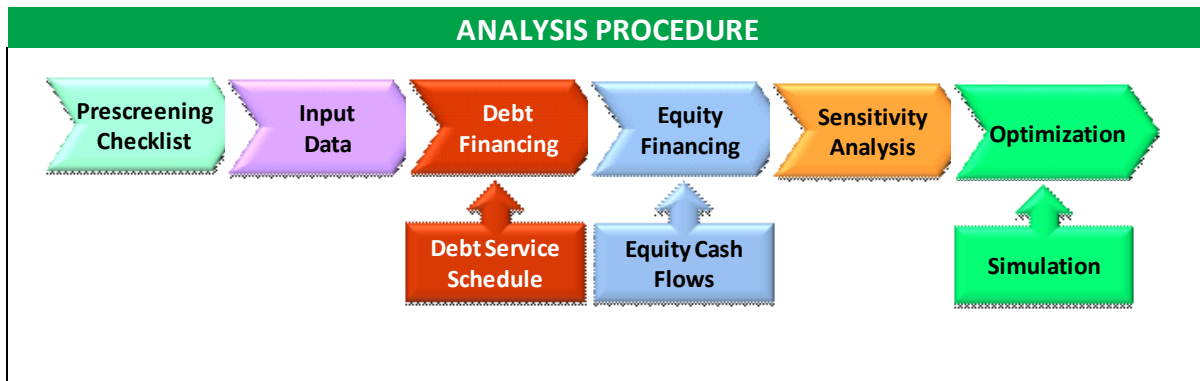
Figure 4.1 PPP Feasibility Study Procedure

4.2 Prescreening Checklist

4.2.1 Institutional Maturity

Considering the needs of the public sector, the pre-screening checklist is developed as a user-friendly and generic tool for measuring the project potentials as a PPP candidate. Meanwhile this checklist would be easy to be understood and answered yet detailed enough to be effective, and be an aligned tool with decision support capabilities in comparing projects with the minimum required qualifications for a PPP candidate project. In meeting the objectives of P3FAST, the pre-screening checklist is added to the toolkit in order to provide a user-friendly pre-project screening tool that can help state DOT decision makers decide whether a project has potentials to be considered as a PPP project, or if it should be developed using traditional delivery methods. This screening tool is designed to check three important criteria of a project: Institutional Maturity, Project Maturity and Market Maturity.

Institutional Maturity, or organizational maturity, checks how prepared the state DOT is in terms of legislation, resources such as internal manpower, guidelines, external advisors/consultants, and public and political support. This criterion is very important because it determines whether the state DOT has the necessary resources and authorities to deliver a project under a PPP agreement. In case a state DOT does not have the necessary resources to procure, manage, and control a PPP contract they should not enter into any PPP agreement. Otherwise, the success of the project will be at risk.

Project Maturity checks the characteristics of the project and aligns them with the minimum required characteristics for a PPP project. This section checks the alignment of the

project with the long term transportation plan of the state DOT. It is important to understand that the DOT long term plan should drive projects and not the other way around. In addition to the alignment with the long term transportation plan, the clearness of the project's objectives and scope, completeness of preliminary designs, and the availability of sufficient studies such as traffic studies, environmental studies, market needs, and geotechnical studies will be checked in this section. The ability of the project to obtain necessary permits and approvals and the financial sustainability of the project are among other factors that should be checked in this section. In other words, this section checks the preparedness of the project for feasibility studies, registration, and the bidding process. If the project does not have mentioned documentations, studies, and designs it should be stopped in this stage until all the necessary material is ready. Otherwise, the project may face serious problems and it may be stopped in one another phase such as the bidding, construction, or operation while incurring more cost and more time delays.

Market Maturity indicates the capacities and conditions of the market to accept, compete for, and deliver the project. Before putting a project in the market, the state DOT should check the condition of the financial market, financial and technical capacities of companies in the market, the level of competitiveness, and also the level of public commitment to attracting private funds and debt. This section is very important because market conditions change very often. It has a considerable effect on the procurement and negotiation of a PPP contract and therefore the success or failure of a PPP project.

4.2.2 Scoring System and Method

Decision makers involved in the front edge planning effort for screening PPP candidate projects should use the Project Pre-screening checklist shown in Appendix A. This checklist consists of three main sections that are broken down into 16 questions. These questions will be individually described in the next section.

The questions should be answered subjectively as either "yes", "no" or "maybe". Answer "yes" should be given if the decision maker is confident that the requested piece of information or material in the question is available, sufficient and accurate. If the decision maker is not sure whether the mentioned material in the question is available, sufficient and accurate, he/she should answer "maybe". "Maybe" means there is a need for further investigations. However, if the decision maker is sure that the content in the question is not currently available, and it is not likely that it can be obtained in a reasonable timeframe in the future, he/she should answer "no" to question.

To score the overall Project Pre-screening checklist, the answers to all questions should be considered. If the answer to all questions is "yes", the decision maker can conclude the project is a good candidate to be considered as a PPP project. If the answer to even one question is "no", the project should not be considered as a PPP candidate. In case the answer to all questions is yes, except some questions which are answered as "maybe," but there is still no answer as "no", the decision maker will need to investigate further to either find enough data and supporting material to change "maybe" to "yes," or based on his experience, the need for the project and supports for the project decide whether to let the project go to the next step or not.

It should be noted that while analyzing the checklist, one should consider the three different categories, and the different actions that should be taken depending on the answers to the questions in each category. If there is any "maybe" or "no" answer to the questions in the Institutional Maturity category, the state DOT should start working on their own PPP program and resources. If the problematic questions are in the Project Maturity category, a change in project scope, design, or further studies and investigations may be needed in order to get the project pass through the checklist test. If the problematic questions are in the Market Maturity section, the state DOT may need to wait until the market conditions are better or start building professional connections with the private companies who are able to do the project and offer more commitment in order to reach a better market maturity.

4.2.3 Elements Discussion

▪ Category A: Institutional Maturity:

This category measures the level of preparedness of the state DOT in delivering a project through PPP. It checks the authorization of the state DOT, its legitimacy in using this authorization, its capabilities, and its resources both in terms of man power and tools, and the necessary political and public support needed for delivering a PPP project.

- *Authorization: Is the public agency authorized to develop PPP projects?*

  This question checks the authority of the state DOT in developing infrastructure projects using PPP. The answer to this question should be "yes" if there exists a legislation enabling the state DOT to procure the project using a PPP contract. If legislation is in the process and is expected to be passed sometime soon, the answer should be "maybe". Otherwise, this question should be answered as "no."

- *Need: Is there any need to finance the project through debt and/or private equity?*

  PPPs are associated with more debt for the state DOT and also more private debt and/or equity debt. This debt increases the financial risks for the public agency. This increase in the risk is only accepted if there is a need for the extra funds and a justification for using debt. The answer to this question should be "yes" if the annual budget of the state DOT is not sufficient to meet its long term transportation plans. If the state DOT has enough budgets, but adding more funds in terms of debt will help them to allocate some of the funds to other projects which have substantial public benefits, the answer should be "maybe". Otherwise, this question should be answered as "no."

  Resources: Are there necessary resources in terms of in-house employees and consultants/advisors to manage PPPs?
  A PPP contract is more complicated than traditional delivery methods. Therefore, it needs more resources both in terms of in-house staff, external advisors, and consultants. Before starting any PPP contract, the state DOT should make sure that the necessary resources to procure and manage the project using PPP are available to them. If such resources are available, the answer to this question should be "yes." If such resources are not available, but they can be obtained or contracted in the short term, the answer should be "maybe." Otherwise, this question should be answered as "no."

- *Guideline: Has the agency established guidelines and regulations for PPP projects?*

  In order to prepare the foundations for PPP procurement, the state DOT needs to establish regulations and develop guidelines. These regulations and guidelines help state DOTs to

have a standard process in procuring, developing, and managing PPPs. If such regulations and guidelines exist, the answer to this question is "yes." If they are under development and will be implemented soon, the answer should be "maybe." Otherwise, it should be "no."

- *Support: is there necessary political/public support for the PPP project?*

  One of the most important elements in the success or failure of PPPs is the political and public support for PPP projects. It is very hard, if not impossible, to deliver a successful PPP project if the key decision makers do not support the project, or if there is a huge public resistance against developing the project using PPP. If the necessary political support and will to develop the project using PPP exists, the answer to this question should be "yes." If it is not clear whether such support exists, this question should be answered as "maybe." Otherwise, the answer should be "no."

- Category B: Project maturity:

  This category checks all the necessary documents that a PPP project will need in order to be procured successfully such as design, studies, documents, permits, etc. Some of these documents are needed in the next steps of this feasibility study toolkit, some are needed to register the project as a PPP project, and some others are needed to enable private companies to bid on the project.

  - *Alignment with Long term Plans: Is the project aligned with agency long term transportation plan?*

    It should always be considered that state DOTs should drive PPP projects based on their needs and not the other way around. Therefore, PPP projects should be aligned with the long term transportation plans of the states. The goal of this question is to check whether such alignment exists or not. As discussed before, the answer can be "maybe" if the evaluator is not sure whether the project is fully aligned with the long term transportation plan or not.

  - *Preliminary designs: Is the preliminary design of the project sufficient for private sector involvement?*

    Before doing any more financial analysis of the project, preliminary design of the project should be completed. It is very important to know about the alignment of the road, and its preliminary design before coming up with any cost or schedule estimates. If preliminary design of the project is sufficient to do cost/schedule estimates and sufficient for the private partner to prepare bidding documents, the answer to this question is "yes." If such documents are not complete, but are expected to be completed soon, the answer to this question is "maybe," otherwise it is "no."

  - *Preliminary studies and analysis: Are there sufficient data (traffic, geotechnical, environmental, etc) available to run the financial analysis?*

    Preliminary studies and reports are needed for cost/schedule estimates as well as the future revenue prediction for the project. They are as important as the preliminary design and are needed before any financial analysis or bid price estimation can be performed. This question should be answered in the same manner as the previous question.

- *Permits and approvals: Does the project meet minimum requirements to obtain environmental and other major permits and approvals?*

  It is important to make sure the project has the minimum requirements to obtain the necessary permits and approvals. Otherwise, it will be too costly to stop the project after the construction has begun due to lack of permits and approvals or environmental lawsuits. If the project is expected to raise issues regarding approvals and permits which cannot be easily resolved, the answer to this question should be "no." If the issues are expected to be resolved with minor scope changes or negotiations, the answer should be "maybe." Otherwise the answer is "yes."

- *Value for Money (VfM): Does the PPP alternative provide VfM compared to the traditional delivery method?*

  In order to give legitimacy to the state DOT to procure a project using PPP, there should be a justification that PPP will add value to the project compared to the traditional delivery methods. This value can be in terms of cost/schedule savings, risk sharing, managerial skills, technological benefits, or better service to the citizens. If anyone of the mentioned factors exists, the answer to this question is "yes." If none exists, the answer is "no." If none of the factors exists, but still the evaluator believes the project adds value in other ways, the answer is "maybe."

- *Future Revenue Prediction: is the project expected to have sustainable demand (traffic)?*

  Any PPP project is highly dependent to its traffic revenue to pay off its debt. If the traffic study predicts that the projects will enjoy a sustained traffic demand in the future, the revenue stream of the project can be forecasted with more confidence. In such a case, the answer to this question is "yes." If such confidence does not exist, but still there is no point to believe the project will not have a sustainable traffic demand, the answer should be "maybe." However, if because of any reason the traffic demand in the future will not be sustainable, the answer should be "no."

- *Cost efficiency: Is the project cost suitable for PPP delivery?(minimum requirement of 50M$)*

  Due to more complexity of PPPs compared to traditional delivery methods, the cost associated with procuring and managing a PPP project is relatively higher. Considering the extra cost associated with PPPs, it is not economically feasible to pursue PPP projects that are less than $50M. It should be also added that the based on the TIFIA portfolio, the minimum project cost that has ever applied for TIFIA loan is $280M for Reno Transportation Rail Access Corridor (ReTRAC) (FHWA). Therefore, the chance that a project can be less than $50M and still be a successful PPP project is very limited. The answer to this question is "yes," if the project value is more than $50M, "maybe" if it is close to $50M, and "no" if it is below $50M. If the project cost is below $50M and there is still a need to deliver it though PPP, the answer is "maybe."

- Category C: Market Maturity:

This category checks the market condition for a PPP project. Since PPPs are meant to bring private investment into the project, it is very important to check the possibility of such investment before putting the project in the market. In this section, the financial market

condition, the availability of funds and loans, and the availability of qualified developers are checked. In addition, the level of competition in the market and the level of public commitment to the project are considered in order to check the possibility of a fair negotiation.

- *Financial market condition: Are the financial market conditions favorable for developing a PPP project?*

  It is very important to consider the financial market conditions such as availability of loans, interest rates, and loan payment schedules before procuring a PPP project. The answer to this question is "yes" if financial market is healthy, loans are available, interest rates are reasonable and loan payment schedules are flexible. The answer is "maybe" if some of the mentioned factors exist, and the rest are expected to improve in the early future. The answer is "no" if the mentioned factors are not in favor of a PPP procurement and there is no sign of improvement for the early future.

- *Industry capacity: are there enough qualified private companies in the PPP market?*

  Before advertising for any PPP project, the state DOT should make sure that there are qualified companies in the market who are financially and technically capable of delivering the PPP project. If such companies exist in the market, this question should be answered as "yes." If such companies do not exist right now, but there is a good chance that they will enter the market in the early future, the answer should be "maybe." Otherwise the answer is "no."

- *Market interest: Is there enough market interest in the project?*

  No PPP contract can be signed without market interest. At the same time, a good PPP contract can be negotiated fairly only if there is a good competition in the market. Therefore, if there are 2 or more companies interested in the project, the answer to this question is "yes." If there is at least one company, the answer to this question is "maybe." If there is no company interested in the project, the answer should be "no."

- *Public Commitment: Is there enough public commitment (federal/state/local) to attract private investors?*

  One of the main factors that attract private investors in public projects is public commitment. If such commitment does not exist, the investment risk for private investors will be too high. So they will either not show interest in the project, or they may increase their bid price to cover the risk premium. The answer to question is "yes" if the necessary commitment to the project exists among officials and decision makers. Otherwise, the answer is "no."

4.2.4 Prescreening Analysis Output

To score the overall Project Pre-screening checklist, the answers to all questions should be considered. If the answer to all questions is "yes," it will suggest considering the project as a "PPP candidate." In case the answer to all questions is yes, except some questions that are answered as "maybe," and there is still no answer as "no," it will consider the project as a "conditional PPP candidate" and suggest a "to-do-list" in order to address the issues and solve them. If the answer to even one question is "no," the toolkit will suggest the project is not ready to be a PPP candidate and should be analyzed and financed through traditional delivery methods.

It should be noted that while analyzing the checklist, one should consider the three different categories, and the different actions that should be taken depending on the answers to the questions in each category. If there is any "maybe" or "no" answer to the questions in the Institutional Maturity category, the state DOT should start working on their own PPP program and resources. If the problematic questions are in the Project Maturity category, a change in project scope, design or further studies and investigations may be needed in order to get the project passed through the checklist test. If the problematic questions are in the Market Maturity section, the state DOT may need to wait until the market conditions are better, or start building professional connections with the private companies who are able to do the project and offer more commitment in order to reach a better market maturity.

Decision makers involved in the front edge planning effort for screening PPP candidate projects should use the Project Pre-screening checklist shown in Appendices A. This checklist consists of three main sections that are broken down into 16 questions. The questions in this checklist are answered subjectively as either "yes," "no," or "maybe." The toolkit will analyze the answers and based on those answers will suggest whether the project can be considered as a "PPP candidate," a "conditional PPP candidate," or "Not ready for PPP."

4.3 Debt Financing Test

Highway projects can be financed through debt and equity in addition to Federal grants and state funds. When arranging the finances, debt is preferred over equity as debt is available at low costs and enables the sponsors to retain control over the assets, but debt must be repaid with interest at a predetermined repayment schedule. If due debt is not repaid on schedule a refinancing must be considered. Otherwise the ownership of the project goes to the debt holders. To protect debt holders' interests the debt service is calculated by factoring expected revenue by debt service coverage ratio (DSCR) and commonly has a higher payment priority than payment to equity investors. Putting all these conditions in place the debt financing evaluation serves the four fold objective of determining bonding capacity and total debt capacity, verifying self financing ability and equity need, identifying debt structure, and establishing debt service schedule.

Debt for transportation projects can be arranged from several sources. The project sponsors can borrow from financial institutes, issue long term bonds, or obtain government credit assistance to raise the funds. Since the life cycle of transportation projects spreads over several decades the projects are typically financed through long term bonds. These bonds can be categorized as senior and junior bonds depending on their payment priorities. Senior bonds have the highest payment priority and are typically secured by project revenues. Moreover the senior bonds are required to be above the BBB investment level rated by credit rating agencies like Fitch and Standard & Poor's. Junior bonds on the other hand are charged at a higher interest rate. Additionally, there are various Federal and state credit assistance available for the transportation projects including The Transportation Infrastructure Finance and Innovation Act (TIFIA), Section 129 Loans, GARVEEs, and Private Activity Bonds. TIFIA program provides low cost Federal credit assistance in the form of direct loans, loan guarantees, and standby lines of credit. The TIFIA term could extend up to 35 years after the completion of construction. In essence TIFIA is a junior loan but must be secured through the project revenues.

Considering the borrowing and repayment details for senior bonds, the bonding capacity can be defined as the maximum amount of senior bonds secured through the project revenues. In most cases operation and maintenance costs, financial expenses, and reserves are deducted first from the project revenue streams. Therefore, the bonding capacity is smaller than the discounted value of project revenues. Senior bonds, junior bonds, and other debt instruments collectively contribute towards the total debt capacity. If the total debt along with Federal grants and state funds is greater than the project expenses, the project is able to self finance. Otherwise equity investment must be considered to fill the financial gap.

The Debt Financing Test is a systematic analysis which requires the analyst to collect, process, and use the data from various sources and apply them in the financial framework of the project. The process requires inputs of estimates of capital costs, yearly operation and maintenance costs, user toll rates, inflation, user demand, revenue sources, traffic growth rate, pavement maintenance schedule, ramp up period details, truck percentage, truck toll rate, and Debt Service Coverage Ratio (DSCR). The processed input data is used in a systematic nine stepped procedure to determine the self financing ability of the project. The debt financing evaluation process is shown in the following Figure 4.2.

The whole process provides answer to the basic question – whether the project can finance through debts and other grants or if it will require equity investment? Other valuable information regarding estimates of yearly revenue, project capital expenses, operation and maintenance costs, bonding capacity from different sources, total bonding capacity, and in some cases the information about financial gap will be available at the completion of the debt financing evaluation process.

INPUTS	PROCEDURE	OUTPUTS
Project Development Plan Project Cost Estimates Traffic Study Report Historical Data Project Specific Details Market Conditions Expert Judgement	1. Estimate Capital Costs 2. Estimate O&M Costs 3. Estimate User Fee Revenue 4. Estimate Other Revenues 5. Develop Free Cash Flows 6. Develop DS Schedule 7. Estimate Bonding Capacity 8. Develop DS For TIFIA 9. Obtain Total Debt Capacity 10. Verify Self Financing Ability	Expected Revenue Expected Costs Bonding Capacity Total Debt Capacity Debt Service Schedule Financing Gap

Figure 4.2 Debt Financing Evaluation Process

4.4 Equity Financing Analysis

The Equity Financing Analysis follows the debt financing test and is conducted only if the project cannot be financed through debts. The equity financing analysis provides us information about the likely private equity investment in a project and whether or not public equity will be required for the project. This requires a systematic stepwise approach which is shown in the following Figure 4.3.

The equity financing test uses the debt capacity, free cash flow statements, and debt service schedules obtained as output during the debt financing test. The free cash flow statements and the debt capacity schedules are used to determine the equity cash flows. The equity cash flow represents the yearly cash available to pay the equity investors. Therefore, discounting these equity cash flows to the year of analysis using the private sector's minimum rate of return we can obtain the possible equity investment. This represents the private sector investment considering base case.

However, when the private sector gets involved in the project, it is expected that they may adopt an aggressive approach to generate higher revenues, or may successfully generate higher benefits from their mainstream businesses (like appreciation in real estate values or better customer service by laying electricity cables, telephone lines, internet cables, etc.) Considering these conditions the revenues must be increased. Moreover the private sector willingly takes higher risks with the expectation of higher returns. All these points collectively represent an aggressive case in which the private sector expects much stronger revenue streams when compared to the public sector. This requires development of equity cash flows under the aggressive case which are then used to estimate the possible equity investment. Since the revenue streams are stronger in the aggressive case, the private sector will be willing to invest much more when compared to what the public sector may evaluate.

INPUTS	PROCEDURE	OUTPUTS
Debt Evaluation results Aggressive Case Details Tax Rate Other Revenue (Private Sector) Risk Evaluation For Equity	1. Estimate Debt & DS 2. Develop Equity Cash Flows 3. Estimate Equity Investment 4. Develop Aggressive Case 5. Develop Equity Cash Flows under Aggressive Case 6. Estimate Equity Investment under Aggressive Case 7. Select MARR For Private 8. Determine Equity Capacity 9. Identify Public Funds	Equity Capacity Equity Cash Flow Equity Rate of Return Public Funds Needed

Figure 4.3 Equity Financing Analysis Process

The private equity investment can be calculated by using an appropriate minimum attractive rate of return for the private sector. This rate of return can be calculated using information from the market or from earlier dealing with similar private sector companies. Using this rate of return the expected private investment capacity can be estimated by calculating the spread of private investment between the aggressive case and the base case. If the private equity with the total debt capacity and other funds are able to meet the capital requirement then the public sector does not require any upfront investment in the project. However, if the total falls short then the financial gap must be closed through public investment.

4.5 Sensitivity and Optimization

The PPP feasibility analysis is based on several assumptions. These assumptions are necessary to conduct the feasibility analysis and small changes to some of these variables strongly affect the final result of the analysis. Hence, it is necessary to identify the variables that affect the output and also to quantify the effect on the results. Sensitivity analysis provides this

information. This helps the sponsoring department to concentrate and prioritize their efforts on improving the confidence margins on the influential factors. As a result, sponsoring departments get refined results which can help them to take decisions with confidence. The excel toolkit developed for ALDOT enables the users to conduct sensitivity analysis using the Tornado Charts feature.

The Tornado Charts in the toolkit are prepared by varying the values of the critical factors by a certain small amount. Variation in critical factors generates tornado charts for financial capacity of the project and the private investment. These charts provide quantified amounts of increase or decrease in the outputs when the critical factor is increased or decreased. For example if the DSCR is increased then the debt capacity decreases which increases the chances of private investment in the project. On the other hand if the revenues are increased financial capacity for the project increases and at the same time the private investment chances also increase. Similar other valuable information can be obtained in dollar value after conducting sensitivity analysis.

When a project needs equity investment, the public sector is required to divide equity between the private and the public sectors. The public sector may want private equity since the private sector may want to allocate the available funds to some other project or may want to save some funds to meet unexpected, unwanted events or invest in some other more fruitful opportunities. However the public sector does not want to allow too much private investment in public projects since the private sector would want a payback at a higher/the highest rate of return which may not protect public interests. Hence, the public sector must determine the percentage of private equity investment in a way that would enable the public sector to achieve its objectives. This can be achieved by employing optimization techniques.

A linear programming (LP) model was developed to optimally structure equity in a financial structure of the PPP model. The objective function was set up to maximize public sector benefits and included three major parts which represented debt financing availability, private financing, and public sector opportunity costs. Several constraints were set up to define the mutual relationships between these components and achieve other goals. First, a debt capacity constraint defined the maximal amount of debt that a PPP project could secure. Second, the debt holders required that the debt service be secured with higher priority from net revenue. Third, PPP financing must be able to cover project costs. Fourth, the rate of return for private partners must be large enough to attract private investments, yet small enough to protect public interests. The factors $i_{P(min)}$ and $i_{P(max)}$ in the constraints defined the lower and upper boundaries of the rate of return for private equities. A few more constraints were added to this model to meet the LP modeling requirements. This model used deterministic values of all the variables however revenues are stochastic. Hence the LP model was upgraded to account for the randomness of expected revenue streams. Readers can refer Sharma (2009) for more details on various models and the results.

4.5 Feasibility AnalysiS Tool - P3FAST

A spreadsheet based on model, namely the Public Private Partnership Feasibility Analysis Tool (P3FAST) was developed to facilitate the feasibility analysis process. The model has seven modules and allows users to conduct PPP analysis in a timely manner and with limited data input. The build-in pre-screening checklist helps users identify the PPP maturity in terms of institutional maturity, project maturity, and market maturity. With a user input interface, the model is able to calculate debt and equity financing capacity. The sensitivity analysis module helps to identify the risk factors that significantly impact the financing structure and analysis results. The optimization model allows the users to design an optimal borrowing structure considering the benefits and opportunity costs of using private funds.

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5 Case Study: US 280

5.1 Introduction

US Highway 280 travels through rural areas and smaller cities in southeastern Alabama to Birmingham. It has rapidly developed over the past 20 years and become a principle artery serving commuter traffic and suburban development in southeast Jefferson County and northeast Shelby County. Numerous shopping centers are located on U.S. 280 between the E.B. Stephens Expressway and Eagle Point Parkway, which make it the most congested roadway in the Birmingham metropolitan area. The six-lane facility was designed to accommodate 50, 000 daily vehicles. However, recent traffic counts recorded an average daily traffic (ADT) of over 74,000 vehicles on the west side of I-459 interchange and over 82,000 vehicles on the east side in 2008.

The expansion of US280 has been part of the state's long term transportation plan. In 2005, a study supported by ALDOT recommended a combination of improvements including adding interchanges and extra lanes to alleviate the congestion on the corrdior (Jones and Sullivan 2005). This kind of improvement is costly and would use up the state's annual capital
5 budget for transportation improvement projects. In 2009, the enacted public private partnership legislation (HB217) provides an alternative funding mechanism for ALDOT to improve transportation infrastructure through private sector involvement and funding. ALDOT then proposed an elevated toll road plan on the U.S. 280 expansion. In the design plan, the segment on the west of I-459 interchange will have six local lanes devoted to free travel and four at-grade express lanes converted into toll lanes. Six lanes of free access roadway would remain on the east side of I-459 and an elevated toll road with four express lanes would be built from I-459 interchange to Eagle Point Parkway (Figure 5.1). The project cost is estimated at $300 million for the western segment and $410 million for the elevated road. ALDOT plans to use innovative financing to build the tollway and collect the tolls to pay back. The suggested toll is 20 to 25 cents a mile. The electronic toll collection technique will be used to smooth traffic flow and reduce operation costs.

While tolling major corridors is a new concept for Alabama, there are groups of citizens, business owners, and land holders opposed to the elevated tollway plan. Especially, a group named ReThink280 proposed an toll-free expressway plan in early 2010 as an alternative to ALDOT's plan (MacDonald 2010). *This research will neither evaluate the merits nor endorse any organizations or plans. The analysis in this paper, however, is aimed to demonstrate the process of financial feasibility study under various PPP scenarios.*

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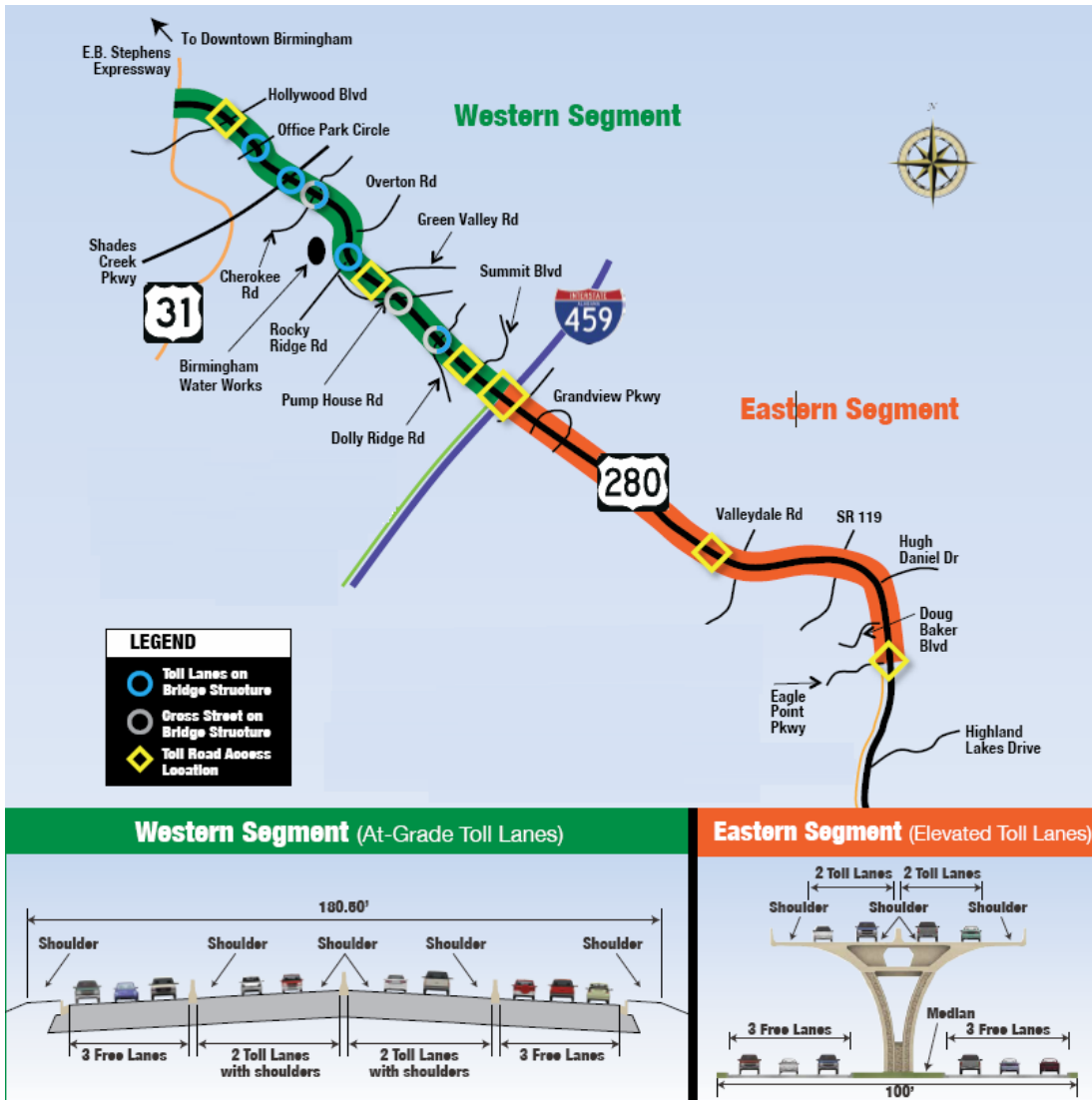
Figure 5.1 Proposed US 280 Elevated Tollway (source: ALDOT)

5.2 US 280 Traffic Count

The traffic on US 280 has grown over 35% for the past 8 years on the east side of I-459 interchage. On the west side, due to the capacity of E.B. Stephens Expressway, the traffic growth has been less than 10% since 2000. On average, the yearly traffic growth is 1.4% on the west side and 2.7% on the east side. The annual average daily traffic reachs 74,200 vehicles on the west side and 82,690 vehicles on the east side (Table 5.1).

Table 5.1 US 280 Traffic Count (source: ALDOT)

Counter ID	AL-37-147	AL-37-148	AL-37-152	AL-59-152	AL-59-148
Station	147	148	152	152	148
County	37	37	37	59	59
City	35	35	35	35	35
Route	38	38	38	38	38
Milepoint	0.52	1.42	4.57	5.94	7.09
AADT 2008	64220	74160	74200	82690	57390
AADT 2007	69330	81040	82940	82940	57560
AADT 2006	64550	73770	78940	78910	55670
AADT 2005	63510	80010	80190	78910	55670
AADT 2004	61960	77390	78690	78690	55530
AADT 2003	61170	71680	71720	71720	50560
AADT 2002	61830	72390	72470	72470	51040
AADT 2001	61470	72490	67320	67320	48020
AADT 2000	59330	70100	67220	67220	42400
K	10	10	11	11	11
D	55	55	60	60	60
TDHV	2	2	5	5	8
TADT	3	3	6	6	10
Heavy	40	40	60	60	65
Functional Class	14	14	14	14	14
Description	E. OF OFFICE PARK CIRCLE	W. OF B'HAM WATER WORKS	@ SHELBY CO. LINE	@ CAHABA RIVER	NW. OF OVERTON ROAD
Average Gro	1.1%	0.9%	1.4%	2.696%	4.0%

5.3 PPP Feasibility Study and Financing Plan

Given the limited capital budget available to ALDOT, one major issue associated with the U.S. 280 expension project is to identify alternative funding sources. This paper fouceses on the project financial analysis to demonstrates the process and outcome of proposed feasibility study guidelines. The analysis follows conservative assumptions to prevent overestimating project revenues and underestimating costs and uncertainties.

The analysis establishes 2011 as the base year for the purpose of estimating project cash flows. The entire construction will be complete within three years. The traffic will ramp up at an average rate of 4% for the first 4 years during the operation, then gow at a rate of 2.7% annually until year 30, then at 1% for the rest of project life. The initial traffic in the first year of operation is assumed to be 82,690 vehicles per day (2008 number). 30% of the traffic will be diverted onto the toll lanes. The average toll rate for passenage cars is $.20 cents per mile and $.55 cents per mile for trucks. Truck traffic is estimated to be 8% of the ADT. Annual inflation rate is 2%. Because the project uses electronic toll collection, the operation cost is insignificant and assumed to be 20% of project revenue annually. Considering a favorable market condition for project financing, the senior secured debt yields 5.5% . TIFIA rate is set at 4%. From the Yahoo bond center, current A-rated 30-year municipal bonds have a 4.7% yield, while A-rated corporate bonds at 6.1% of yield.

Table 5.2 Data Input for Feasibility Study

Input	Base Case	Aggressive Case
Project Cost	$710 million	$710 million
Construction Duration	3 years	3 years
Toll Rate (passage car)	20 cents/mile	20 cents/mile
Toll Rate (truck)	55 cents/mile	55 cents/mile
Truck percentage	8%	15%
Toll Rate Growth	2%	2%
External to External Traffic	30%	50%
Average Annual Daily Traffic (2008)-	82690	82690
Toll Trips	30%	50%
Rampup Period	4 years	4 years
Traffic Growth-Rampup Period	4%	4%
Traffic Growth- Mature Period	2.7% (year 5-30) and 1% after year-30	2.7% (year 5-30) and 1% after year-30
Operating and Maintenance	20% of annual revenue	20% of annual revenue
Overlay Cost (	$ 6.5 millions	$ 6.5 millions
Overlay Duration	12 years	12 years
Cost Growth Rate	2%	2%
Senior Bond Term	30 years	30 years
Senior Bond Yield (August 10, 2010)	5.5%	5.5%
Underwriting Fee	1%	1%
TIFIA Rate (August 10, 2010)	4%	4%

Three financing plans are evaluated namely, a) public financing scenario; b) DBFO; c) hybrid financing. Plan A assumes the Alabama toll authority finances the project through a revenue bond secured against future net revenue. TIFIA funding is also available. Under plan B, a private company will finance and build the project then get the investment back through toll collection within the concession period. A hybrid financing plan is also considered consisting of public financing and availability payment. Under this plan, ALDOT will pledge $14 million a year to the project for the entire loan term depending upon the performance and service level.

P3FAST model was used to evaluate the financing structure. Table 2 shows the sources and uses of funds under each scenario. In particular, the agency is able to use project toll revenue to secure a debt up to $395 million, which includes $250 million of senior debt and $145 million of TIFIA loan. Additionally, private equity investment will total $60 million under the base case, and up to $263 million under the aggressive case scenario. Plan C appears very promosing, under which, the project is in a sense self-financed. With a small amount of upfront funds from ALDOT, the project revenue will be able to secure debts to cover all project costs and increase the reserve fund for debt service.

Table 5.3 US 280 Financing Structure

PLAN A: Public Financing			PLAN B : DBFO			PLAN C : Hybrid Financing		
Sources of Funds			Sources of Funds			Sources of Funds		
Revenue Bond	$	250	Revenue Bond	$	250	Revenue Bond *	$	516
TIFIA Loan		146	TIFIA Loan		146	TIFIA Loan		236
Interests Income		26	Interests Income		26	Interests Income		26
ALDOT Funding		349	Private Equity (minimum		60	ALDOT/ATRBTA		86
			ALDOT Funding		289			
Total Sources	$	770	Total Sources	$	770	Total Sources	$	864
Use of Funds			Use of Funds			Use of Funds		
Project Cost	$	710	Project Cost	$	710	Project Cost	$	710
Capitalized interest		60	Capitalized interest		60	Capitalized interest		110
						Reserve fund		44
Total Uses	$	770	Total Uses	$	753	Total Uses	$	864
						* ALDOT pledges $14 million annually		

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6 Summary

6.1 Research Findings

PPPs as an alternative to the traditional approaches of project delivery and public financing are increasingly gaining acceptance. Partnering with private sector firms has the potential to attract private capital, reduce project costs, and deliver higher quality transportation projects more quickly than traditional financing and contracting methods. However, PPPs are not a cure-all for the shortage of transportation funding. The transportation agencies must be cautious in making a balance between attracting private capital and protect public interest while considering PPP procurement.

This research identified the Alabama PPP framework under recently passed PPP legislation – Act 2009-769. The governance structure of Alabama PPP projects are demonstrated on five aspects: organizational set-up, financing mechanism, PPP formats, user fee approach, and procurement process. Based on the PPP government framework, this research developed a PPP feasibility study procedure that includes 5 components: namely a pre-screening checklist, debt financing test, equity financing evaluation, sensitivity analysis, and capital structure optimization. This integrated analysis framework will be able to help state DOTs:

- ❖ Evaluate PPP maturity;
- ❖ Identify risk factors and implementation barriers;
- ❖ Determine debt capacity;
- ❖ Establish minimum requirement for private equity investment;
- ❖ Determine equity and public fund needs
- ❖ Evaluate financing plans;
- ❖ Optimize capital structure under uncertainty.

The U.S. 280 expansion project was analyzed as a case study to demonstrate the effectiveness of the guidelines. The analysis compared three financing plans and concluded that the project is able to generate strong cash flows for debt financing. Less than one half of project capital cost would be covered by ALDOT funds under a public financing scenario. Private equity investment would range from $60 to $263 million depending on investors' risk preference. Especially, the analysis exposed that with $14 million annual payment pledged by ALDOT to the toll authority, the project would be self-financed and maintain $44 million debt service research funds.

The state of Alabama was used as an example to illustrate the analysis framework. However, the process and procedures discussed in this paper are applicable to other states, particularly those just launching their PPP programs. The Excel based feasibility study toolkit called P3FAST is a generalized software package and could facilitate financial analysis, opportunity evaluation, and financing structure determination for PPP projects.

6.2 Recommendations and Future Research Needs

The feasibility study guidelines, along with the Excel-based software package will be delivered to ALDOT. Although the in-house analysis should not substitute professional financial services provided by financial advisors and institutions, implementation, and application of the products developed from this research would help ALDOT establish and improve ALDOT's in-house capability to evaluate PPP projects at the early phase of project development. Considering the complexity and size of PPP projects, this capability is especially important for ALDOT to ensure accountability, transparency, and public interest during the PPP project decision making process. Other recommendations are as follows.

❖ ALDOT could integrate the partnership program into the multimodal transportation development process. Highway, rail, and transit projects could all be developed through various PPP formats.

❖ Successful PPP projects in essence root in an appropriate allocation of project risks between public and private partners. Identifying, evaluating, pricing, and allocating those risks are still challenging work and deserve further investigation.

❖ PPP project governance becomes an increasingly important issue that requires public agencies to integrate good governance standards into PPP practices including participation, decency, transparency, accountability, fairness, efficiency, and sustainable development. The guidebook on good governance practices in PPPs, however, has not been established.

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Acronyms and Abbreviation:

AADT	Annual average daily traffic
AASHTO	American Associate of State Highway and Transportation Officials
AFP	Alternative Financing and Procurement
AGC	Associated General Contractors
ALDOT	Alabama Department of Transportation
ATRBTA	Alabama Toll Road, Bridge, and Tunnel Authority
BAN	Bond Anticipation Notes
BDB	Bid-Design-Build
BOOT	Build-Own-Operate-Transfer
BOT	Build- Operate-Transfer
CTTS	Central Texas Turnpike System
CDA	Comprehensive Development Agreement
CDOT	Colorado Department of Transportation
DB	Design-Build
DBF	Design-Build-Finance
DBOM	Design-Build-Operate-Maintain
DOT	Department of Transportation
DSCR	Debt Service Coverage Ratio
ETC	Electronic Toll Collection
FDOT	Florida Department of Transportation
FHWA	Federal Highway Administration
GARVEE	Grant Anticipated Revenue Vehicle
GO Bond	General Obligation Bond
HOT	High Occupancy Toll
HOV	High Occupancy Toll
IDB	Industrial Development Bond
IRB	Industrial Revenue Bond
IRR	Internal Rate of Return
ITS	Intelligent Transportation Systems
LOV	Low Occupancy Vehicle
MnDOT	Minnesota Department of Transportation
NPV	Net Present Value
NTP	Notice to Proceed
O & M	Operation and Maintenance
PAB	Private Activity Bond
PFI	Public Finance Initiative
PPPs	Public Private Partnerships
PSC	Public Sector Comparator
RFP	Request for Proposal
RFQ	Request for Qualification
ROR	Rate of Return
SAFETEA-LU	Safe Accountable, Flexible, Efficient Transportation Equity Act
SFP	Solicitation For Proposal
SIB	State Infrastructure Bank
SMP	Statewide Mobility Partner
SOV	Single Occupant Vehicle
TIFIA	Transportation Infrastructure Finance and Innovation Act
TIP	Transportation Improvement Program
TxDOT	Texas Department of Transportation
UTCA	University Transportation System for Alabama
VDOT	Virginia Department of Transportation
VfM	Value for Money

Glossary

Agency Debt — That portion of the gross federal debt incurred when a federal agency other than the Department of the Treasury (Treasury) is authorized by law to issue debt securities directly to the public or to another government account.

Asset — Tangible or intangible items owned by private companies, local governments or the federal government, which would have probable economic benefits that can be obtained or controlled by the private or public entity.

Authorizing Legislation — Substantive legislation, proposed by a committee of jurisdiction other than the House or Senate Appropriations Committees, that establishes and continues the operation of a federal program or agency either indefinitely or for a specific period or that sanctions a particular type of obligation or expenditure within a program. This term is used in two different ways: (1) to describe legislation enacting new program authority, that is, authorizing the program, and (2) to describe legislation authorizing an appropriation.

Build-Own-Operate (BOO) — Under a BOO transaction, the contractor constructs and operates a facility without transferring ownership to the public sector. Legal title to the facility remains in the private sector, and there is no obligation for the public sector to purchase the facility or take title. A BOO transaction may qualify for tax-exempt status as a service contract if all Internal Revenue Code requirements are satisfied.

Build/Operate/ Transfer (BOT) or Build/Transfer/ Operate (BTO) — Under the BOT option, the private partner builds a facility to the specifications agreed to by the public agency, operates the facility for a specified time period under a contract or franchise agreement with the agency, and then transfers the facility to the agency at the end of the specified period of time. In most cases, the private partner will also provide some, or all, of the financing for the facility, so the length of the contract or franchise must be sufficient to enable the private partner to realize a reasonable return on its investment through user charges. At the end of the franchise period, the public partner can assume operating responsibility for the facility, contract the operations to the original franchise holder, or award a new contract or franchise to a new private partner. The BTO model is similar to the BOT model except that the transfer to the public owner takes place at the time that construction is completed, rather than at the end of the franchise period.

Buy-Build Operate (BBO)	A BBO transaction is a form of asset sale that includes a rehabilitation or expansion of an existing facility. The government sells the asset to the private sector entity, which then makes the improvements necessary to operate the facility in a profitable manner.
Cash Flow	Cash flow is cash receipts minus cash disbursements from a given operation or asset for a given period. A cash flow statement shows all sources and uses of cash reflected in the balance sheet cash account from one period to the next.
Cost-Benefit Analysis (Economics Term)	An analytic technique that compares the costs and benefits of investments, programs, or policy actions in order to determine which alternative or alternatives maximize net benefits (economic efficiency). Cost-benefit analysis attempts to consider all costs and benefits to whomever they accrue, regardless of whether they are reflected in market transactions. The costs and benefits included depend upon the scope of the analysis, although the standard federal analysis is national in scope. Net benefits of an alternative are determined by subtracting the present value of costs from the present value of benefits.
Current Dollar (Economics Term)	"In current dollars" means valued in the prices of the current year. The current dollar value of a good or service is its value in terms of prices current at the time the good or service is acquired or sold.
Debt Service	ServicePayment of interest on, and repayment of principal on, borrowed funds. The term may also be used to refer to payment of interest alone.
Design-Build-Operate (DBO)	In a DBO project, a single contract is awarded for the design, construction, and operation of a capital improvement. Title to the facility remains with the public sector unless the project is a design/build/operate/transfer or design/build/own/operate project. The DBO method of contracting is contrary to the separated and sequential approach ordinarily used in the United States by both the public and private sectors. This method involves one contract for design with an architect or engineer, followed by a different contract with a builder for project construction, followed by the owner's taking over the project and operating it. A simple design-build approach creates a single point of responsibility for design and construction and can speed project completion by facilitating the overlap of the design and construction phases of the project. On a public project, the operations phase is normally handled by the public sector or awarded to the private sector under a separate operations and maintenance agreement. Combining all three phases into a DBO approach maintains the continuity of private sector involvement and can facilitate private-sector financing of public projects supported by user fees generated during the operations phase.

Discount Rate (Economics Term)	The interest rate used to determine the present value of a future stream of receipts and outlays, or in cost-benefit analysis, of benefits and costs. This use of the term is completely distinct from that in monetary policy, and the interest rates involved are generally not those charged by Federal Reserve Banks.
Feasibility Study	A study to examine the viability of taking on a project. A feasibility study takes place during a project initiation phase and is made before significant expenses are engaged. I typically include technical and economic aspects. The conclusion will determine if a production decision can be made and is used for financing arrangements.
Equity	Equity is the difference between fair market value of the property and the amount still owed on its mortgage.
Grant	A federal or state financial assistance award making payment in cash or in kind for a specified purpose.
Lease/Develop/Operate (LDO) or Build/Develop/Operate (BDO)	Under these partnership arrangements, the private party leases or buys an existing facility from a public agency; invests its own capital to renovate, modernize, and/or expand the facility; and then operates it under a contract with the public agency. A number of different types of municipal transit facilities have been leased and developed under LDO and BDO arrangements.
Life-Cycle Costs	The overall estimated cost, both government and contractor, for a particular program alternative over the time period corresponding to the life of the program, including direct and indirect initial costs plus any periodic or continuing costs of operation and maintenance.
Net Present Value (Economics Term)	The present value of the estimated future cash inflows minus the present value of the cash outflows.
Operations and Maintenance	A public partner (federal, state, or local government agency or authority) contracts with a private partner to provide and/or maintain a specific service. Under the private operation and maintenance option, the public partner retains ownership and overall management of the public facility or system.
Operations, Maintenance, and Management	A public partner (federal, state, or local government agency or authority) contracts with a private partner to operate, maintain, and manage a facility or system providing a service. Under this contract option, the public partner retains ownership of the public facility or system, but the private party may invest its own capital in the facility or system. Any private investment is carefully calculated in relation to its contributions to

operational efficiencies and savings over the term of the contract. Generally, the longer the contract term, the greater the opportunity for increased private investment because there is more time available in which to recoup any investment and earn a reasonable return.

Present Value	The worth of a future stream of returns or costs in terms of money paid immediately (or at some designated date). (Differs from Net Present Value.) A dollar available at some date in the future is worth less than a dollar available today because the latter could be invested at interest in the interim. In calculating present value, prevailing interest rates provide the basis for converting future amounts into their "money now" equivalents.
Public-Private Partnership	Under a public-private partnership, sometimes referred to as a public-private venture, a contractual arrangement is formed between public and private-sector partners. These arrangements typically involve a government agency contracting with a private partner to renovate, construct, operate, maintain, and/or manage a facility or system, in whole or in part, that provides a public service. Under these arrangements, the agency may retain ownership of the public facility or system, but the private party generally invests its own capital to design and develop the properties. Typically, each partner shares in income resulting from the partnership. Such a venture, although a contractual arrangement, differs from typical service contracting in that the private-sector partner usually makes a substantial cash, at-risk, equity investment in the project, and the public sector gains access to new revenue or service delivery capacity without having to pay the private-sector partner.
Public PurposeDebt	Public purpose debt is debt used to finance a project intended to be ofvalue to the general public. Such debt can include ordinary governmentsecurities, such as general obligation bonds or revenue bonds, as well asqualified private activity bonds.
Request for Proposals (RFP)	An RFP is an announcement, often by a government agency, of a willingness to consider proposals for the performance of a specified project or program component. A request for proposals is often issued when proposals for a specific research project are being sought.
Request for Qualifications (RFQ)	An RFQ is a procurement tool routinely used by state and local governments and the private sector to select partners in major systems acquisitions, mainly those involving real estate development transactions. This approach differs from the traditional request for proposals approach in that it places greater emphasis on the actual qualifications of the potential contractor—his or her track record—rather than how well the potential contractor responds to detailed project specifications and requirements.

Revenue Bonds	Revenue bonds are bonds (instruments of indebtedness) issued by the public sector to finance a facility or equipment purchase, which, unlike general obligation bonds, are not backed by the full faith and credit of the government. Instead, their revenues are generated from the facility or equipment that they finance. Because they are state or local government bonds, their interest earnings are tax exempt under the Internal Revenue Code.
Tax-Exempt Lease	Under a tax-exempt lease arrangement, a public partner finances capital assets or facilities by borrowing funds from a private investor or financial institution. The private partner generally acquires title to the asset, but then transfers it to the public partner either at the beginning or end of the lease term. The portion of the lease payment used to pay interest on the capital investment is tax exempt under state and federal laws. Tax-exempt leases have been used to finance a wide variety of capital assets, ranging from computers to telecommunication systems and municipal vehicle fleets.

Volume II

Feasibility Study Guideline

Table of Contents

1 Introduction

1.1 PPP Definition

A Public Private Partnership (PPP) is an agreement between a public agency (federal, state, or local) and a private sector in a contractual manner. It involves bringing in creative skills and management efficiency from business practice and reducing government risk involvement in the provision of public services by using private companies for an effective approach to enhance project productivity. For example, a public agency may provide right-of-way and the right to collect user fees, while a private firm provides financing, technological innovation, and on-going service.

PPP has a long history in many countries, but it became popular worldwide in the 1980s. The United Kingdom and Australia are widely recognized as forerunners of PPPs which have been used in various sectors of facility delivery since the 1980s (3). In the US, due to an increasing funding shortfall in the transportation sector, more and more states start to embrace PPPs to develop and maintain transportation infrastructure. It has become the USDOT's policy to incorporate PPP into various transportation programs. By the end of 2009, approximately 10 states had used PPP on transportation projects. Over 20 states had passed legislation to authorize PPP for the construction of new transportation infrastructure (Cui and Lindly 2010). Similar legislative efforts are underway in many other states.

- ❖ Private Contract Services
- ❖ Alternative Project Delivery, including design-build, design-build-warranty, design-build-operate-maintain, design-build-finance-operate, and build-operate-transfer.
- ❖ Multimodal Partnerships
- ❖ Joint Development
- ❖ Long-term Lease or Concession Agreements
- ❖ Availability Payment

1.2 Feasibility Study Guideline

The Act #2009-769 (House Bill 217) establishes a PPP program in the state of Alabama that enables the Alabama Department of Transportation (ALDOT) to form a partnership with private parties to develop toll roads, bridges, causeway, tunnels, or other transportation facilities. Based on the framework defined by the PPP legislation, this guideline defines a process model that can help ALDOT engineers evaluate PPP opportunity, identify debt and equity needs, and determine financing structure. The process model follows the steps described in Figure 1-1. Major evaluation steps are

- ❖ PPP prescreening to identify PPP opportunity at the program level
- ❖ Debt financing test to evaluate the feasibility of public financing
- ❖ Equity financing analysis to identify equity financing capacity
- ❖ Sensitivity analysis to determine the robustness of analysis result against uncertainty
- ❖ Optimization model to establish a financing target at the contracting stage
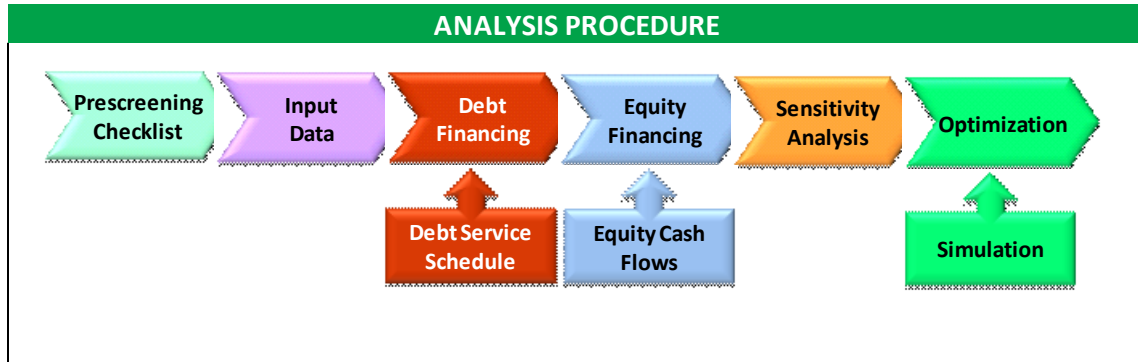
Figure 1-1 PPP Feasibility Study Procedure

1.3 How should the Guideline be used?

The guideline is aimed to help ALDOT engineers conduct in-house analysis on PPP projects. A set of analysis routine is defined in the guideline which an engineer can follow easily. The in-house analysis; however, should not substitute professional analysis services provided by financial advisors and institutions.

The guideline provides a procedure to evaluate PPP projects at various stages of the project development. One should be aware that the feasibility study is based on many assumptions and data inputs. Early analysis should be completed so that a solid analysis can be conducted based on reliable data input.

An Excel-based software package, namely Public Private Partnership Feasibility Analysis Tool (P3FAST), is developed to facilitate the analysis. In addition to providing a manual analysis procedure, the guideline also specifies the inputs and parameters used in the P3FAST calculation. Interested people should contact ALDOT or Dr. Qingbin Cui (*cui@umd.edu*) at the University of Maryland for the software package.

2 PPP Prescreening

2.1 Objective

PPP pre-screening helps decision makers decide in early stages of the feasibility study, whether a project has potentials to be considered as a PPP project, or if it should be developed using traditional delivery methods. Since resources of state DOTs are limited and there are many projects competing for those resources, it is essential to better allocate resources in order to achieve better outcomes. This pre-screening checklist analyzes three different aspects of a PPP candidate project - Institutional Maturity, Project Maturity and Market Maturity. Based on simple questions that will be asked in each category, it will suggest three different outcomes: "Passed," "Conditionally Passed," and "Not Passed." The objective of the prescreening is to:

- ❖ Evaluate PPP opportunities
- ❖ Evaluate PPP maturity
- ❖ Identify PPP implementation barriers and risks

2.2 Structure

The checklist is developed based on a comparison of different checklists available for PPP projects. An evaluation template is presented in Table 2-1. This checklist has three main categories: Institutional Maturity, Project Maturity and Market Maturity. Each one of these categories checks one aspect of a PPP project.

Institutional maturity checks the level of preparedness of the state DOT in delivering a project through PPP. It checks the authorization of the state DOT, its legitimacy in using this authorization, its capabilities and resources both in terms of man power and tools, and also the necessary political and public support needed for delivering a PPP project. Project maturity checks all the necessary documents that a PPP project will need in order to be procured successfully, such as design, studies, documents, permits, etc. Some of these documents are needed in the next steps of this feasibility study toolkit, some are needed to register the project as a PPP project, and some are needed to enable private companies to bid on the project. Market maturity checks the market condition for a PPP project. Since PPPs are meant to bring private investment into the project, it is very important to check the possibility of such investment before putting the project in the market. In this section, the financial market condition, the availability of funds and loans, and the availability of qualified developers are checked. In addition, the level of competition in the market and the level of public commitment to the project are considered in order to check the possibility of a fair negotiation.

Each category includes different questions which focus on different element of a PPP contract. Each one of these elements plays a substantial role in the success or failure of a PPP project, so it is very important to check the existence of the minimum requirements for each element before proceeding to the next steps of the project feasibility study. The elements included in each category are as follows:

- *Category A: Institutional Maturity:*

Authorization: Is the public agency authorized to develop PPP projects?

This question checks the authority of the state DOT in developing infrastructure projects using PPP.

YES	There exists a legislation enabling the state DOT to procure the project using a PPP contract.
MAYBE	A legislation is in the process and is expected to be passed sometime soon
NO	Otherwise.

Need: Is there any need to finance the project through debt and/or private equity?

PPPs are associated with more debt for the state DOT and more private debt and/or equity investment. The debt increases the financial risks for the public agency. This increase in the risk is only accepted if there is a need for the extra funds and a justification for using debt.

YES	The annual budget of the state DOT is not sufficient to meet its long term transportation plans.
MAYBE	State DOT has enough budget, but adding more funds in terms of debt will help them to allocate some of the funds to other projects that have substantial public benefits.
NO	Otherwise.

Resources: Are there necessary resources in terms of in-house employees and consultants/advisors to manage PPPs?

A PPP needs more resources in terms of in-house staff, external advisors, and consultants. Before starting any PPP contract, the state DOT should make sure that the necessary resources to procure and manage the project using PPP are available to them.

YES	Necessary resources in terms of in-house staff, external advisors, and consultants are available.
MAYBE	Such resources are not available, but they can be obtained or contracted in the short term
NO	Otherwise.

Guideline: Has the agency established guidelines and regulations for PPP projects?

In order to prepare the foundations for PPP procurement, the state DOT needs to establish regulations and develop guidelines. These regulations and guidelines help state DOTs to have a standard process in procuring, developing and managing PPPs.

YES	Necessary regulations and guidelines exist.
MAYBE	Necessary regulations and guidelines are under development.
NO	Otherwise.

Support: Is there necessary political/public support for the PPP project?

One of the most important elements in the success or failure of PPPs is the political and public support for PPP projects. It is very hard if not impossible, to deliver a successful PPP project if the key decision makers do not support the project or if there is a huge public resistance against developing the project using PPP.

YES   Necessary political support and will to develop the project using PPP exists.

MAYBE   It is not clear whether or not such support exists.

NO   Otherwise.

- *Category B: Project maturity:*

Alignment with Long term Plans: Is the project aligned with agency long term transportation plan?

It should always be considered that state DOTs should drive PPP projects based on their needs and not the other way around. Therefore, PPP projects should be aligned with long term transportation plan of the states. The goal of this question is to check whether or not such alignment exists.

YES   The project is fully aligned with the long term transportation plan.

MAYBE   The project is slightly different than the long term transportation plan but is not in contradiction with it.

NO   Otherwise.

Preliminary designs: Is the preliminary design of the project sufficient for private sector involvement?

Before doing anymore financial analysis on the project, preliminary design of the project should be completed. It is very important to know about the alignment of the road and its preliminary design before coming up with any cost or schedule estimates.

YES   The preliminary design of the project is sufficient to do cost/schedule estimates and sufficient for the private partner to prepare bidding documents.

MAYBE   The mentioned documents are not yet completed but are expected to be completed soon.

NO   Otherwise.

Preliminary studies and analysis: Are there sufficient data (traffic, geotechnical, environmental, etc) available to run the financial analysis?

Preliminary studies and reports are needed for cost / schedule estimates as well as the future revenue prediction for the project. They are as important as the preliminary design and are needed before any financial analysis or bid price estimation can be performed. This question should be answered in the same manner as the previous question.

YES   The preliminary studies and reports of the project are sufficient to do cost/schedule estimates, as well as for the private partner to

prepare bidding documents.

> MAYBE   The mentioned documents are not yet completed but are expected to be completed soon.
>
> NO   Otherwise.

Permits and approvals: Does the project meet minimum requirements to obtain environmental and other major permits and approvals?

> It is important to make sure the project has the minimum requirements to obtain the necessary permits and approvals. Otherwise, it will be too costly to stop the project after the construction has begun because of environmental lawsuits or lack of permits and approvals.
>
> YES   Project is expected to raise issues regarding approvals and permits which cannot be easily resolved.
>
> MAYBE   The issues can be resolved with minor scope changes or negotiations.
>
> NO   Otherwise.

Value for Money (VfM): Does the PPP alternative provide VfM compared to the traditional delivery method?

> In order to give legitimacy to the state DOT to procure a project using PPP, there should be a justification that PPP will add value to the project compared to the traditional delivery methods. This value can be in terms of cost/schedule savings, risk sharing, managerial skills, technological benefits, or better service to the citizens.
>
> YES   Delivering the project using PPP adds value to the project in terms of cost/schedule savings, risk sharing, managerial skills, technological benefits, or better service to the citizens.
>
> MAYBE   None of the mentioned factors exists, but the project is still believed to be essential and valuable for the public.
>
> NO   Otherwise.

Future Revenue Prediction: Is the project expected to have sustainable demand (traffic)?

> Any PPP project is highly dependent on traffic revenue to pay off its debt. If the traffic study predicts that the projects will maintain a sustainable traffic demand in the future, the revenue stream of the project can be forecasted with better confidence.
>
> YES   If the traffic study predicts that the projects will maintain a sustainable traffic demand in the future, the revenue stream of the project can be forecasted with better confidence.
>
> MAYBE   Such confidence does not exist, but there is still no point to believe the project will not have a sustainable traffic demand.
>
> NO   Otherwise.

Cost efficiency: Is the project cost suitable for PPP delivery (minimum requirement of $50M)?

Due to more complex PPPs compared to traditional delivery methods, the cost associated with procuring and managing a PPP project is relatively higher. Considering this extra cost associated with PPPs, it is not economically feasible to pursue PPP projects that are less than $50M.

YES   The project value is more than $50M.

MAYBE   The project value is less than $50M, but there is an urgent need to deliver it through PPP.

NO   Otherwise.

- *Category C: Market Maturity:*

Financial market condition: Are the financial market conditions favorable for developing a PPP project?

It is very important to consider the financial market conditions, such as availability of loans, interest rates, and loan payment schedules before procuring a PPP project.

YES   The financial market is healthy, loans are available, interest rates are reasonable, and loan payment schedules are flexible.

MAYBE   Some of the mentioned factors exist, and the rest are expected to improve in the near future.

NO   Otherwise.

Industry capacity: Are there enough qualified private companies in the PPP market?

Before advertising for any PPP project, the state DOT should make sure that there are qualified companies in the market who are financially and technically capable of delivering the PPP project.

YES   There are qualified companies in the market who are financially and technically capable of delivering the PPP project.

MAYBE   Such companies do not exist right now, but there is a good chance that they will enter the market in the near future.

NO   Otherwise.

Market interest: Is there enough market interest in the project?

No PPP contract can be signed without market interest. At the same time, a good PPP contract can be negotiated fairly only if there is a good competition in the market.

YES   There are two or more companies interested in the project.

MAYBE   There is at least one qualified company in the market

NO   Otherwise.

Public Commitment: Is there enough public commitment (federal/state/local) to attract private investors?

> One of the main factors that attracts private investors in public projects is the public commitment. If such commitment does not exist, the investment risk for private investors will be too high, so either they will not show interest in the project, or they may increase their bid price to cover the risk premium.
>
> YES   The necessary commitment to the project exists among high rank officials and decision makers.
>
> MAYBE   There is a good chance that the necessary commitment to the project exists among high rank officials and decision makers.
>
> NO   Otherwise.

2.3 Scoring and interpreting results

To score the overall Project Pre-screening checklist, the answers to all questions in the three different categories should be considered. Based on the answers, three different outputs may occur: "Passed," "Conditionally Passed," or "Not Passed." Each category will PASS the test if all the answers are "Yes." If there are some "MAYBE's," but no "NO's," that criteria is considered "Conditionally Passed". In this case, a list of "Issues to be addressed" will be provided to the user. However, if there is any answer "NO," the category will not pass. If all the mentioned criteria are cleared and passed, the checklist will suggest considering the project as a PPP candidate. If there is a "NOT PASSED" category but there is at least one "Conditionally Passed" category, the project can still pass this pre-screening test if the problems in the "Issues to be addressed" list are solved. These issues can usually be solved by some minor changes or more studies. It will consider the project as a "conditional PPP candidate" and suggest a "to-do-list" in order to address the issues and solve them. This checklist will be available through the toolkit in a separate report page.

If there is a "Not Passed" for any one of the mentioned categories, the checklist will suggest the project is not ready to be a PPP project and should be analyzed and financed through traditional delivery methods. It is important to understand that this output does not imply the project is not a good project or is not economically feasible. It only suggests that PPP is not a good delivery method for the project, and other traditional delivery methods should be considered for the project.

Table 2-1 PPP Prescreening Template

INSTITUTIONAL MATURITY:	Yes	No	Maybe
Authorization: Is the public agency authorized to develop PPP projects?			
Need: Is there any need to finance the project through debt and/or private equity?			
Resources: Are there necessary resources in terms of in-house employees and consultants/advisors to manage PPPs?			
Guideline: Has the agency established guidelines and regulations for PPP projects?			
Support: Is there necessary political/public support for the PPP project?			
PROJECT MATURITY:			
Alignment with Long Term Plans: Is the project aligned with the agency long term transportation plan?			
Preliminary designs: Is the preliminary design of the project sufficient for private sector involvement?			
Preliminary studies and analysis: Are there sufficient data (traffic, geotechnical, environmental, etc) available to run the financial analysis ?			
Permits and approvals: Does the project meet minimum requirements to obtain environmental and other major permits and approvals?			
Value for Money (VfM): Does the PPP alternative provide VfM compared to the traditional delivery method?			
Future Revenue Prediction: Is the project expected to have sustainable demand (traffic)?			
Cost efficiency: Is the project cost suitable for PPP delivery?(minimum requirement of $50M)			
MARKET MATURITY:			
Financial market condition: Are the financial market conditions favorable for developing a PPP project?			
Industry capacity: Are there enough qualified private companies in the PPP market?			
Market interest: Is there enough market interest in the project?			
Public Commitment: Is there enough public commitment (federal/state/local) to attract private investors?			
Evaluation Results			

3 Debt Financing Test

3.1 Objective

Highway projects can be financed through debt and equity in addition to Federal grants and state funds. While the next chapter will focus on equity financing issue, this chapter is aimed to evaluate the debt financing. The primary objective of debt financing evaluation is four fold as follows:

- Determine bonding capacity and total debt capacity
- Verify self financing ability and equity needs
- Identify debt structure,
- Establish debt service schedule.

3.2 Debt Financing Basics

Debt is preferred to equity in project finance due to low cost and retained control over the assets. However debt must be repaid with interest at a predetermined repayment schedule. If due debt is not repaid on schedule, a refinancing plan must be arranged. Otherwise, the ownership of the project will be taken over by the debt holders. To protect debt holders' interests, the debt service commonly has a higher payment priority than any payment to equity investors.

Debt for transportation projects can be arranged from several sources. The project sponsors can borrow from financial institutions, issue long term bonds, or obtain government credit assistance to raise the funds. Since the life cycle of transportation projects spans several decades, the projects are typically financed through long term bonds. These bonds can be categorized as senior and junior bonds depending on their payment priorities. Senior bonds have the highest payment priority and are typically secured by project revenues. Moreover, the senior bonds are required to be above the BBB investment level rated by credit rating agencies, like Fitch, Moody's, and Standard & Poor's. Junior bonds, on the other hand, are charged at a higher interest rate due to their low payment priority. Additionally, there are various Federal and state credit assistance options available for the development of transportation projects, including the Transportation Infrastructure Finance and Innovation Act (TIFIA), Section 129 Loans, Grant Anticipation Revenue Vehicles (GARVEEs), and Private Activity Bonds. The TIFIA program provides low cost Federal credit assistance in the form of direct loans, loan guarantees, and standby lines of credit. The TIFIA term could extend up to 35 years after the substantial completion of construction. In essence, TIFIA is a junior loan but must be secured through project revenues.

The bonding capacity is defined as the maximum amount of senior bonds secured through the project revenues. In most cases, operation and maintenance costs, financial expenses, and reserves are deducted first from the project revenue streams. Therefore, the bonding capacity is smaller than the discounted value of project revenues. Senior bonds, junior bonds, and other debt instruments together contribute towards the total debt capacity. If the total debt, along with

Federal grants and state funds, are greater than the project expenses, the project is able to self finance. Otherwise, equity investment must be considered to fill the financial gap.

3.3 Structure of Debt Financing Analysis

The Debt Financing Test is a systematic analysis, which requires the analyst to collect, process, and use the data from various sources and apply them in the financial framework of the project. Input of appropriate data will enable the analyst to conduct the Debt Financing Test and obtain information about the financial structure of a project. Figure 3-1 provides an overview of the debt financing evaluation processes.

The process will require inputs of estimates of capital costs, yearly operation and maintenance costs, user toll rates, inflation, user demand, revenue sources, traffic growth rate, pavement maintenance schedule, ramp up period details, truck percentage, truck toll rate, and Debt Service Coverage Ratio (DSCR). These all inputs will enable the users to estimate project cash flows and obtain valuable information.

As the process completes, the whole process will provide answers to the basic question – Can the project finance through debts and other grants or will it require equity investment? Other valuable information regarding estimates of yearly revenue, project capital expenses, operation and maintenance costs, bonding capacity from different sources, total bonding capacity and, in some cases, the information about financial gap will be obtained as the process completes.

INPUTS	PROCEDURE	OUTPUTS
Project Development Plan Project Cost Estimates Traffic Study Report Historical Data Project Specific Details Market Conditions Expert Judgment	11. Estimate Capital Costs 12. Estimate O&M Costs 13. Estimate User Fee Revenue 14. Estimate Other Revenues 15. Develop Free Cash Flows 16. Develop DS Schedule 17. Estimate Bonding Capacity 18. Develop DS For TIFIA 19. Obtain Total Debt Capacity 20. Verify Self Financing Ability	Expected Revenue Expected Costs Bonding Capacity Total Debt Capacity Debt Service Schedule Financing Gap

Figure 3-1 Debt Financing Evaluation Overview

3.4 Evaluation Procedure

The debt financing evaluation includes 10 steps as discussed below.

- *Step 1: Estimate Project Capital Costs*

The PPP project costs can be broadly classified as initial capital costs, operation, and maintenance costs. The initial capital costs include all the expenses to develop the infrastructure asset starting from the conceptual development till the substantial completion of the construction. The capital costs typically include

- ❖ Construction Costs
- ❖ Design and Engineering Service
- ❖ Legal, Financial and other Consultancy Fees
- ❖ Agency Costs
- ❖ Capitalized Interests During Construction

Several other types of costs could be also included in the initial capital costs depending on the project plan and characteristics, e.g. right-of-way acquisition, contingency reserve, loan origination fees, and other project specific costs. Most of this information can be obtained from the project development plan, project cost estimates, and preliminary analysis reports. Additional valuable data should also be obtained from the project plan and analysis report, including construction duration and schedule, lane mileage, and configuration. In this way, the timing and cost of these items can be estimated. This helps calculate the project cash flows and enables the feasibility analysis considering the time value of money.

If the project cost is estimated much before the planned construction year, the project costs should be adjusted by the construction cost index or inflation rate. Table 3-1 shows the inflation indices and highway construction cost indices for the past 10 years. Considering the current financial conditions, inflation index is suggested to be 2% to 3% annually. For example, if the project construction cost is estimated at $100 million in 2010, given the construction starts in 2012 with a 2% inflation rate, the inflation adjusted construction cost is calculated as:

Inflation indexed project cost = $ 100* (1+ 2%) (1 + 2%) = $104.04 million

Table 3-1 Highway Construction Cost Index (Washington DOT)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
CCI	128	129	139	145	170	176	228	230	241	223	243
CCI Growth	---	0.8%	7.8%	4.3%	17.2%	3.5%	29.5%	0.9%	4.8%	-7.5%	9.0%
Inflation	3.4%	2.8%	1.6%	2.3%	2.7%	3.4%	3.2%	2.9%	3.9%	-0.3%	2.0%

- ▪ *Step 2: Estimate Operating and Maintenance Costs*

The costs of keeping the highway operational and maintaining the highways are collectively categorized as O&M Costs. Precise information about the O&M expenses can be obtained from the toll revenue study report from historical data available in the department, or from consulting experts. The rule of thumb for estimating O&M costs is to consider 15%-25% of annual revenue (IBI Group 2007).

The O&M costs can be further broken down into four categories.
- ❖ Operating cost, including uncollectible accounts, credit card fees, back office operations, manual toll collection, violation enforcement, etc.
- ❖ Routine roadway maintenance cost
- ❖ Periodic rehabilitation and repair cost
- ❖ Toll collection system maintenance cost

Operating costs vary greatly according to size, scope, and configuration of toll facilities. As the tolling industry has shown that it generally costs less to collect a toll electronically versus manually, the number of Electronic Toll Collection (ETC) versus manual transactions is a consideration while analyzing operating costs. Detail cost breakdown estimates are typically calculated based on the staffing needs and administrative activities. A rough estimate of each operating cost item is provided in Table 3-2.

Table 3-2 Toll Facility Operating Cost

O&M Cost Item	% of Annual Revenue	Source
Uncollectible accounts	2.5%	WSDOT
Credit card fees	3.45%	WSDOT
Back office operations	varied according to staffing needs	
Manual toll collection	varied according to staffing needs	
Enforcement	$220,000 per officer-year	WYDOT
Annual cost growth	Inflation rate (2.5%)	

Routine maintenance cost covers all routine maintenance activities, e.g. maintaining cleanliness on the highway, removal of snow from the pavements, and maintaining the trees, plants, or grass along the highway. Historical data shows that these costs were relatively small and may be omitted from the Analysis (Lindly 2003). See Table 3-3 for the routine maintenance costs for asphalt pavement and concrete pavement.

Table 3-3 Yearly Routine Maintenance Costs in Alabama (Lindly 2003)

Year	Asphalt Pavement	Concrete Pavement
2002	$173.30 per lane mile	$68.09 per lane mile
2001	$242.14 per lane mile	$87.28 per lane mile
2000	$196.00 per lane mile	$64.40 per lane mile

Roadway rehabilitation and repair expenses are incurred by recurring and non-annual maintenance activities that provide structural or functional enhancement of toll road. Rehabilitation options depend upon local conditions and pavement distress types, but typically include HMA overlays, PCC overlays, hot in-place recycling, and cold in-place recycling. In Alabama, asphalt pavements are resurfaced every 12 years and concrete pavements are rehabilitated every 20 years (Lindly 2003). Table 3-4 and 3-5 provide information of typical pavement overlay schedule and cost.

Table 3-4 Pavement Rehabilitation Schedule (Source ACPA and CDOT 2009)

State	Asphalt Pavement	PCC Pavement
Alabama	12 years	20 years
California	20, 25, 30 and 35 years	
Colorado	10, 20, and 30 years	22
Florida	14 years	20 to 35
Georgia	10 years	20
Maryland	14.8 and 26.6 years	
Virginia	12, 22, 32 and 44 years	10 to 30

Table 3-5 Typical Unit Costs of Pavement Maintenance Treatments

Treatment	Cost	Unit	Year	Source
Overlays	$163,709	lane-mile	2007	Chou 2008
Thin HMA Overlays	$58,856	lane-mile	2007	Chou 2009
Thin Hot-Mix Overlay	$2.09	yd^2	2000	FHWA 2000
Thin Cold-Mix Overlay	$1.50	yd^2	2000	FHWA 2000

- *Step 3: Estimate User Fee Revenue*

The main source of revenue on a PPP project is the user fee revenue. There are several other categories of revenue that contribute to the project revenue and will be discussed under the category of other revenue sources. The user fee revenue is the product of the user fee (toll rate) and the number of users (demand).

Annual User fee Revenue = ADT x Toll-Rate x 365

Estimation of user fee revenue requires that both these elements of user fee revenue are calculated accurately since a high user fee can reduce the demand and a low user fee can increase the congestion on this new facility. As per NCHRP Synthesis 364 several methods are available for estimating the demand on a toll road (Kriger 2006). These methods are listed below in Table 3-6.

Table 3-6 Methodologies Available For Modeling Toll Road Demand

Methodology	Brief Description	States Using These Methods
Activity Based Model	Allows inclusion of pricing into a decision hierarchy	Oregon
Modeling Within Modal Split Component of 4 Step Models	Trips through tolled and non-tolled roads are considered as separate modal split functions.	Phoenix, Arizona, Sacramento and California
Modeling Within Trip Assignment Component of 4 Step Models	Applies diversion of trips within the trip assignment after demand modeling	Texas
Modeled as a post-processor	Used within the 4 step model or exogenously	Washington, DC and San Diego, California
Sketch Planning Method	Estimates traffic as functions of elasticities of demand with respect to travel time. Price and demand are equilibrated in this method.	

Traffic volume and growth, toll rate, and ramp-up data should be obtained from the project traffic study. On a brownfield project, toll trips are estimated as a percentage of existing traffic volumes with a growth rate defined in Table 3-7. On a greenfield project, the analyst should be conservative in using traffic estimates from the traffic study report. The Standard & Poor's report shows that financial institutions typically underestimate the traffic forecasts by 18% (Bain and Wilkins 2002). This adjustment aligns with the findings in the NCHRP Synthesis 364 that there is on average 20-30% of "optimism bias" on toll traffic forecasts.

Table 3-7 Traffic Growth Rate (Fitch 2007)

	Greenfield Toll Road	Brownfield Toll Road
Ramp-up period	Traffic study	5-year historical average
Till year 30	Regional traffic growth	Regional traffic growth
After year 30	0-2%	0-1%

Toll on major corridors ranged factors from $0.10 to $0.40 in recent years, but varies depending on project characteristics, social, and public factors. Table 3-8 lists the minimum and maximum tolls on existing toll facilities in the United States. To improve the accuracy of toll revenue estimates, toll rate obtained from the traffic and toll revenue study should be adjusted by truck percentage (p) and pass-through traffic percentage (q) where, L is the length of the toll road. R_{car} and R_{Truck} are the toll rates per mile for passenger cars and trucks.

$$\text{Adjusted-Toll-Rate} = [R_{car} * (1- p) + R_{Truck} * p] * L * [q + (1-q)/2]$$

Full length commuter toll trips (pass-through traffic) will be charged for using the entire length of the toll way, while partial commuter trips pay half toll for the length of the road. Tolls for large commercial trucks, which are typically 2-5 times charged the amount to passenger vehicles, will generate more revenues. However, estimating the percentage of trucks in the estimated traffic of the region can be a challenging task. Bronzini (2008) reports in his work that according to the Quick Response Freight Manual, service vehicles range from 5% to 13% of the total vehicle miles traveled in urban areas, where 91% are light-duty trucks and 9% are medium to heavy- duty trucks.

Table 3-8 Toll Rates in United States

Facilities	Passenger Car		Truck	
	Min Toll	Max Toll	Min Toll	Max toll
Interstate System Toll Roads	$0.02	$0.27	$0.08	$1.76
Non Interstate System Toll Roads	$0.09	$1. 01	0.31	$2.33
Interstate System Toll Bridges and Tunnels	$0.18	$18.30	$1.15	$53.44
Non Interstate System Toll Bridges and Tunnels	$0.02	$39.42	$0.50	$84.72

(data source: FHWA 2009, http://www.fhwa.dot.gov/ohim/tollpage.htm)

- *Step 4: Estimate Other Revenues*

In addition to user fees, there are other revenue sources available, especially when private equity is involved. These sources of revenue are not related to highway use directly, but still generate decent revenues:
   ❖ Transponder fees
   ❖ Traffic violation penalties
   ❖ Concession fees
   ❖ Advertisement
   ❖ Real estate development
   ❖ Availability payment

In general, the revenue streams from highway projects can come from diverse business activities, and the analyst needs to consider all potential revenue sources. It is extremely important that the analyst collects details of all forms of revenue using project details, consulting experts, or using information from previous projects in the same region. It should be noted that the revenues from these categories may be generated during different time periods of the project life cycle and therefore, must be considered as yearly cash flows and adjusted for time value for money wherever necessary.

- *Step 5: Calculate Free Cash Flow*

Estimating yearly costs and revenues is followed by developing the project free cash flows. The cash flows statement is a financing tool that incorporates information about the cash outflows and cash inflows into the project. It provides valuable information about operating cash flows and cash flows available after deducting all expenses and taxes. A typical process to estimate free cash flow includes the following calculations;

Gross Revenue
- Operation & Maintenance cost
- Amortization / depreciation
- Tax
+ Amortization / depreciation
- Changes in working capital
- Capital Investments   .

= Free Cash Flow

For public agencies and tax exempted organizations, the tax should be set as zero. And free cash flow during the toll road operation phase is equal to the difference of gross revenue and O&M cost. These free cash flow streams are used by banks and other financial institutions to determine the bonding capacity for the project.

- *Step 6: Determine Debt Service Schedule For Senior Bonds*

The project sponsor cannot borrow 100% of the project free cash flow. The debt service is typically part of project free cash flow and calculated by dividing free cash flow by debt service coverage ratio (DSCR). DSCR refers to the amount of cash flow available to meet annual interest and principal payments on debt. It is typically between 1 and 2 for road projects. The selection of DSCR should be based on detailed risk analysis of the toll project. Many factors are considered, including tolling regime, tolling culture in the region, toll escalation, forecast horizon, and toll facility characteristics (Bain 2002). Table 3-9 provides a practical guide for the analyst to determine DSCR. The user is suggested to adjust the suggested DSCR considering special project characteristics.

Senior Debt service = Free Cash Flow / Debt Service Coverage Ratio

Table 3-9 Typical DSCR for Various Toll Facilities

Toll Facility Type	Suggested DSCR
Browfield toll facilities	1.30
Greenfield toll facilities:	
High congestion suburban areas	1.30
Outlying portions of metro areas	1.50
Developed corridors with many alternatives	1.75
Least-developed areas	2.0
Shadow toll/availability payment	1.20

▪ *Step 7: Determine Senior Bonding Capacity*

The Senior Bond Capacity can be obtained using the senior debt service schedule and discounting it to the time of analysis using the lending institutions' rate of return. Generally, the discount rate depends upon the rating of the senior debt. Since toll revenue bonds are typically riskier than government general liability bonds, but less risky than corporate bonds in this analysis, it is suggested to use a discount rate between the current yield for at least A-rated corporate bonds and municipal bonds having the same term-to-maturity. Daily bond yield data is available on Yahoo Bond Center ((http://finance.yahoo.com/bonds/composite_bond_rates).

$$\text{Bonding capacity} = \sum_{t=1}^{N} \frac{(Senior\_Debt\_Service)_t}{(1+discount\_rate)^t}$$

Where N is the bond (or loan) term, which is typically 30 years.

▪ *Step 8: Determine Debt Service For TIFIA*

Transportation Infrastructure Finance and Innovation Act (TIFIA) is the debt available through government initiatives which support infrastructure development. TIFIA provides credit assistance for development of highway projects, and the state transportation departments can borrow money up to 33% of the total project cost. However, TIFIA statues also require that the TIFIA loan is secured by the same revenues sources that secure the senior debt obligations. The TIFIA debt service is calculated by the following formula.

TIFIA debt service = (Free Cash Flow – Senior Debt Service) / 1.1

Where a DSCR of 1.1 is assumed for TIFIA loan. Then the total TIFIA loan amount can be estimated by discounting the TIFIA debt service at TIFIA interest rate. The rate is updated daily on FHWA website (http://www.fhwa.dot.gov/ipd/tifia/index.htm). It is usually 1 basic point (0.01%) over the treasure bond. If the calculated number is larger than 33% of the project cost, the TIFIA capacity should be determined as 33% of the total project cost.

$$\text{TIFIA capacity} = \sum_{t=1}^{N} \frac{(TIFIA\ Debt\ Service)_t}{(1+TIFIA\ rate)^t}$$

▪ *Step 9: Determine the Total Debt Capacity*

If there is still cash flow available, the project sponsor could also use the revenue to secure more junior bonds. The calculation follows the same process on step 7 and 8. The total debt capacity

then consists of all debt capacity, including senior bonds, TIFIA, other junior bonds, and debts. The debt financing structure is also determined. It should be noted that the total debt capacity should be higher if the debts are secured by gross revenues.

$$\text{Total Debt Capacity} = \text{Senior Bonds} + \text{TIFIA loan} + \text{Junior Bonds}$$

- *Step 10: Verify the Self Financing Ability*

In this step, the self financing ability index (SFAI) is typically calculated using the formula below. A project is considered to be self financed if the total debt capacity meets over 90% of the project expenses because lenders require a minimum equity commitment – 10% for a typical project. Otherwise, private equity investments or public funds from the transportation agency are necessary. The amount is the difference of the project cost and debt capacity. Federal grants should be deducted if available. The analyst is suggested to check the project life coverage ratio (PLCR) and loan life coverage ratio (LLCR). They are typically required to be over 1.75 and 1.50 respectively.

$$\text{Self Financing Ability Index (SFAI)} = \text{Debt Capacity} / \text{Project costs}$$

$$\text{Private Equity/Public Fund needs} = \text{Project Cost} - \text{Debt Capacity} - \text{Grants}$$

3.5 Factors Affecting the Debt Capacity Test

Many assumptions and parameters may significantly change the analysis results. Table 3-10 provides the potential impact of several risk factors on the debt capacity. The user could also run the sensitivity analysis of the P3FAST spreadsheet model to gain further details of uncertainty and risk evaluation.

Table 3-10 Impact of Risk Factors on Debt Capacity

Factor	Action	Effect on Debt Capacity
Revenue	Increased	Increases
Cost	Increased	Decreases
Concession Period	Increased	Increases
Toll Rate	Increased	Increases
Traffic Volume	Increased	Increases
O&M Costs	Increased	Decreases
DSCR	Increased	Bonding capacity decreases
Bond interest rates	Increased	Bonding capacity decreases

4 Equity Financing Analysis

4.1 Objectives

Equity financing becomes necessary when grants and scurried debts are not enough to finance a project. Equity investors are typically interested in those projects that can offer attractive high returns. The equity financing analysis is a structured process, which allows the engineers to evaluate the feasibility of equity investment. A the end of the analysis, the user will be able to

- Determine the rate of return on equity investment
- Estimate equity financing capacity
- Identify public funding requirement

4.2 Equity Financing Basics

Equity capital is generally composed of funds that are raised in exchange for an ownership interest in the project. By taking an ownership interest, equity investors may take an active role in managing and operating the facility. However, in comparison to debt financing, which must be repaid over time, equity financing does not have to be repaid. In general, a project is attractive to equity investors when the project demonstrates

- ❖ High growth potential, which means the potential for a high rate of return
- ❖ Clear exit strategy allowing the investors to obtain the return
- ❖ Significant financial returns, which is much higher than the yield of bonds and loans

Equity investors generally conduct a thorough due diligence analysis to assess the likely rate of return associated with the infrastructure project. This analysis is similar in scope to debt holders' analyses but is often accomplished in much less time. The equity investor's due diligence analysis typically includes a review of project details, revenue forecasts, equity commitments, permitting status, government guarantees, and risk allocations. The key requirement for most pure equity investors is sufficient rate of return on their investment. The due diligence analysis, combined with the cost and operating data for the project, enables the investor to calculate the project's financial performance and determine its investment offer based on anticipated returns. An equity investor may be willing to finance up to 100% of the project's installed cost, often with the expectation that additional equity or debt investors will be located at a later time.

4.3 Structure of Equity Financing Analysis

The Equity Financing Analysis follows the debt financing test and is conducted if debt is not enough to finance the project. The equity financing analysis provides information about the likely private equity investment in a project and whether or not public equity will be required for the project. This requires a systematic stepwise process, which is shown in Figure 4-1.

INPUTS	PROCEDURE	OUTPUTS

Debt Financing Results
Aggressive Case Details
Marginal Tax Rate
Other Revenue for Equity
Investment
Risk Evaluation for Equity
	1 Estimate Debt & DS
	2 Develop Equity Cash Flows
	3 Estimate Equity Investment
	4 Develop Aggressive Case
	5 Develop Equity Cash Flows
	   Under Aggressive Case
	6 Estimate Equity Investment
	   Under Aggressive Case
	7 Select MARR on Equity
	8 Determine Equity Capacity
	9 Identify Public Funds
		Equity Financing Capacity
		Equity Cash Flow
		Rate of Return on Equity
		Public Funds Needed

Figure 4-1 Equity Financing Analysis

The equity financing test uses the debt capacity, free cash flow statements, and debt service schedules obtained as outputs from the debt financing test. The stepwise procedure requires estimation of equity cash flow statement and possible equity investment in the project. The procedure further requires development of an aggressive case, which captures the gains expected by the private sector for taking higher risks. The procedure further requires the use of appropriate minimum acceptable rate of return (MARR), determination of equity capacity of the project, and the public equity in the project. Equity financing analysis provides equity capacity of the project, equity cash flows, and the public funds for the project as output. The following section provides details of equity financing analysis.

4.4 Evaluation Procedure

The equity financing analysis can be conducted by using the following 9 steps:

- *Step 1: Estimate Debt and Debt Service*

Equity financing analysis succeeds the debt financing test, and the information about the total debt available for the project and its debt service are available as outputs from the debt financing test. If the debt capacity is not used up, actual debt and debt service will be lower than the results from the debt financing analysis.

- *Step 2 Develop Equity Cash Flows under Base Case*

The equity cash flow statement is developed by using the outputs from debt capacity calculations. When debt capacity is estimated a corresponding debt service schedule is also developed. Lending institutions use DSCR for debt capacity calculations so that the debt service is always secured by revenues. The design of debt service schedule in this way leaves behind the unassigned portion of revenue streams. These unassigned revenue streams are the equity cash flow. The calculation of equity cash flow follows the process in the following template. Individual items may vary depending on financing requirements and project details.

Total Revenue	
- Operating and Routine Maintenance	
- Periodic Structural Maintenance	
Earnings Before Income Tax & Depreciation (EBITDA)	
- Depreciation	
Earnings Before Income Tax (EBIT)	
- Debt Service	
+ Interest Income	
Income Before Tax	
- Tax	
Net Income	
+ Depreciation	
Operating Cash Flows	
- Equity Investment	
+ Construction Profit	
Equity Cash Flows	

- *Step 3 Estimate Equity Investment under Base Case*

Equity cash flow (ECF) represents project cash flow available to pay the equity investors. The net present value (NPV) of these cash flows can be obtained by discounting back equity cash flows.

$$\text{NPV of Equity Cash Flows} = \sum_{t=0}^{T} \frac{ECF_t}{(1+r)^t}$$

ECF_t is the equity cash flow at time t, r is the discount rate, and t is the time in years. The equation gives the NPV of the equity cash flow at a given rate of return. While the minimum attractive rate of return on equity investment is not determined yet, a set of values of NPV is calculated using different rates of return, e.g. 0-40%. If the NPV value is greater than zero at a certain discount rate, equity investors will make money assuming their rate of return is equal to the discount rate. Since NPV represents the profit earned by equity investors at a particular rate of return, equity investors are willing to invest more if NPV is higher.

- *Step 4 Develop Aggressive Case Scenario*

In Step 3, the private equity investment is estimated under a conservative case of revenue stream, assuming the public sector will operate and manage the toll facility. This conservative scenario is typically adopted by the lending institutions. However, the private sector may be more efficient than the public agency in terms of managing toll facilities in that the private equity investors:

❖ Have the ownership of the facility that may allow them to increase the toll rates at their will
❖ Manage the facility better and increase the average daily traffic
❖ Be faster to approve, adopt, and implement measures to operate project smoothly and economically
❖ Aggressively take risks for higher rate of return

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❖ Successfully generate higher benefits from their mainstream businesses (like appreciation in real estate values or better customer service by laying electricity cables, telephone lines, internet cables, etc)
❖ Deliver the project fast and under budget
❖ Diversify their business risks

To develop an aggressive scenario, the analyst should consider a favorable demand market and project performance of a competitive private investor. The aggressive case scenario may be available in the revenue study. Generally, the analyst could expect a higher estimate of:

❖ Average Daily Traffic
❖ Truck traffic
❖ Full length commuter trips
❖ Ramp-up growth rate
❖ Traffic growth after ramp-up period
❖ Other revenue
❖ Toll rate increase

and a low estimate of :
❖ Ramp-up period
❖ O&M cost and growth
❖ Project capital cost
❖ Construction duration

▪ *Step 5 Develop Equity Cash Flows for Aggressive Case*

The process of developing equity cash flow statements is the same as described in Step 2 of this chapter. The only change required is the use of aggressive case revenues instead of base case revenues.

▪ *Step 6 Estimate Equity Investment (for Aggressive Case)*

This step requires following the description in step 3. As the set of NPV values is obtained after this step, the aggressive case will have higher NPV values, indicating that the private sector will be earning higher profits. As a result, they will be willing to invest more, take more risks, and make a higher rate of return. Similarly, a curve will be generated to depict the relationship of equity investment and its rate of return.

It should be noted that the equity investment in Step 3 is estimated considering the project performance under the base case, while in Step 6, the project performance is evaluated assuming more favorable status. One could reasonably conclude that the equity investment under the base case represents the minimum possible private sector investment by a risk-averse private investor. The equity investment under the aggressive scenario, on the other hand, represents the maximum possible private equity investment from a risk-seeking investor. The difference between the two scenarios can be observed from the two curves in Figure 4-2. As shown in the figure, the private

equity investment would be expected at $75M for risk-averse investors and up to approximate $100M for risk-seeking investors when a required rate of return is at 15%.
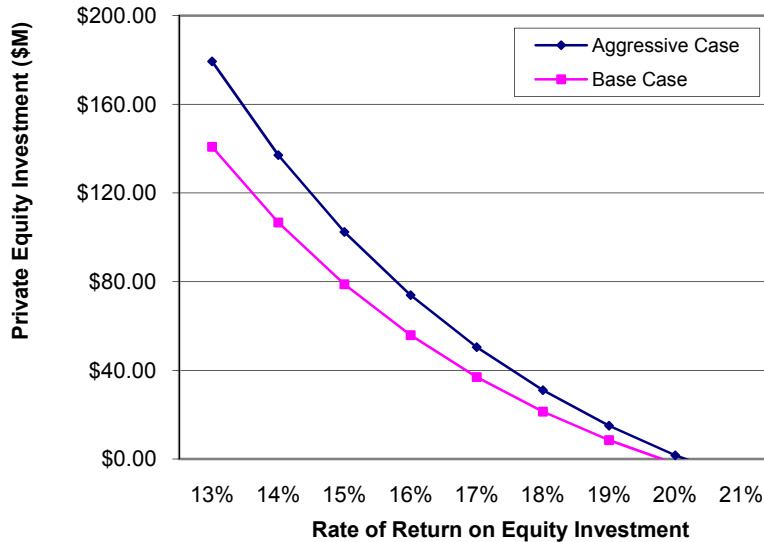
Figure 4-2 Expected Equity Investment Under Base and Aggressive Scenarios

- *Step 7 Select MARR on Private Equity*

The minimum attractive rate of return (MARR) on equity indicates the minimum required rate from private equity investors to participate in the project and take the risks associated with their equity investment. The determination of a MARR is difficult and project specific. It is recommended that the analyst consults financial advisors to reach at an acceptable and reasonable MARR considering the market condition, project risks, competition, etc. Generally, the MARR is determined by the cost of capital and risk premium on the project. The cost of capital is estimated based on the capital asset price model. Project risk premium should be evaluated according to the project characteristics and risk allocation regime. Several other factors should also be considered, including

- ❖ Which companies might be interested to bid on this project?
- ❖ What is the MARR of the interested companies?
- ❖ What MARR was used by these companies on earlier similar projects?
- ❖ What is the MARR allowed on earlier projects?
- ❖ What is the general MARR of the companies in the region?

For practice purposes; however, the analyst may also consider a market analysis and select a MARR from similar projects or private companies. According to the data from the Infrastructure Management group, Macquarie and Cintra – two major PPP players in the United States – a 10-year annual return of 18.4% and 22% respectively were reported. The long term expected return for recent US brownfield toll projects is around 12-13%. The greenfield projects expect an over 14% of rate of return (Tabel 5-1). Additionally, there is an increasing trend in the US that

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public agencies are trying to cap the rate of return on equity investment through profit/revenue sharing provision. Table 5-2 lists the revenue sharing percentage according to the project return. Considering these factors, it is suggested that the analyst selects a MARR of 10-15%, or an amount equal to 2 times of senior bond rate for the feasibility study.

Table 4-1 MARR on PPP Projects

Project/Company	Type	Expected Return
Dulles Greenway	Brownfield	12.60%
Chicago Skyway	Brownfield	12.30%
Indiana Toll Road	Brownfield	12.50%
Pocahontas Parkway	Brownfield	12.60%
SR-125	Greenfield	15-20%
SR-91	Greenfield	13.50%
I-81	Greenfield	13%
Cintra shares	Common stock	22%
Macquarie shares	Common stock	18.4%

Multiple sources: Cintra 2006 Annual Report; Macquarie website; Transurban website; Virginia State Corporation Commission 2007 brief; General Accounting Office; and Infrastructure Management group 2008.

Table 4-2 Revenue Sharing Provision in Texas and Virginia (Mayer 2007)

Equity Return: Texas SH-130	Gross Revenue Sharing to TxDOT (%)	Rate of Return (Project): Pocahontas Parkway	Aggregate Revenue Sharing % to VDOT
Return < 11%	4.65%	Return < 6.5%	None
11% < return < 15%	9.30%	6.5% < Return	40%
Return > 15%	50.00%	Return > 8%	80%

- *Step 8 Determine Equity Capacity*

Once the MARR is selected, a vertical line can be drawn from the MARR value on the X-axis of Figure 4. This intersects the base case and aggressive case curves at two different points. By taking a horizontal projection of these points on the vertical axis, minimum and maximum equity investments can be estimated respectively.

- *Step 9 Identify Public Funds*

If the private equity, along with the total debt and other funds, are enough to meet the capital requirement, then the public sector does not require any upfront investment in the project. However, if the total falls short, then this financial gap must be closed through public investment. This can be represented as

Public Funds = Upfront Capital Requirement – (Debts + Grants + Private Equity)
Where the upfront capital requirement = project cost + capitalized interest + reserve requirement

4.5 Factors Affecting the Equity Capacity Test

Several factors can affect the total equity investment in a PPP project. Though the private investors will try to maximize their profits by investing the least amount of money in the project, the DOTs should make efforts to keep the project attractive so that the private investors are ready to invest big amounts in the project which will be helpful to close the financial gap. Following is a list of few factors which can affect the private equity investment on the project.

Table 4-3 Impact of Risk Factors on Equity Financing

Factor	Action	Effect on Equity Investment
Risk Transfer	Increased	If too much risk is transferred to the private partner, then the private partners may shy away from investment or may demand a higher profit share.
Revenue	Increased	When a project is expected to have larger revenue streams, the private party will be interested to be a part of the PPP project and will therefore be interested in investing relatively higher amounts.
Rate of Return	Increased	If the PPP contract allows for higher rate of returns or if the PPP contract allows the private investors to receive un-capped profit margins, then the private partners can be expected to invest higher amounts.
Concession Period	Increased	PPP projects with longer concession periods will be preferred more by the private investors, and hence, the private partners will be interested to invest more if the concession period is longer.
Competitive Bidding	Increased	If a PPP project has highly competitive bidders, the private partners will be willing to invest more at lower rates of returns just to win the bid. Similarly, when bidding is highly competitive, the DOTs can also expect the private partners to enter the PPP project having a smaller share of the profit.
Profit Share	Increased	If a PPP project offers bigger share in profit, then the private partner will be willing to invest more.

5 Sensitivity Analysis and Optimization

5.1 Objective

Sensitivity analysis provides information about changes in mathematical model outputs due to variation in parameters of the model. Optimization is aimed to obtain an optimal financial structure considering the complexity of the financial structure of PPP projects. The objective of the sensitivity analysis and optimization is to

- Evaluate the effect of risk factors on analysis results
- Identify the risk mitigation priority
- Determine the optimal capital structure under uncertainty
- Obtain the confidence level of expected private investment

5.2 Basic Concepts

Sensitivity analysis provides information about the effects of variation of variables on the output of the models. Sensitivity analysis can be conducted by varying one variable at a time and observing the resulting variation in the output values. If necessary, sensitivity analysis can also be conducted by varying two variables simultaneously. In the former case the sensitivity analysis is called one-way sensitivity analysis, while in the later case, it is called two-way sensitivity analysis (Powell 2007). Tornado diagrams are used here to conduct one-way sensitivity analysis. Several random factors were identified from the model which can have varying effect on the outcome of the results and were used to develop Tornado diagrams. The Tornado diagrams help to quantify the effect of known variation on the outcome of the model.

An optimization model generally consists of an objective function and a set of constraints. The objective function is modeled seeking an answer to the problem statement. While designing capital structure for a highway project, the decision maker desires to reduce the cost of financing but at the same time aims to meet the capital financing requirement. The amount of private equity in the project is crucial since allowing private equity in a project means allowing private sector to take a share of profit. Hence, an LP model is developed to divide the equity component optimally between public and private investors. The objective is to maximize the benefits of the public agency and quantify public interests. The model contains several constraints and each constraint is explained briefly here.

The first constraint in the model represents the debt capacity constraint, which ensures that the debt available for the project is less than or equal to the debt service. The second constraint represents the debt holders' interests and ensures that the debt service is secured by net revenue and reserve funds (if applicable) during the project operation phase. The third constraint implies that the financial plan should meet the capital costs of the project. The fourth and fifth constraints, respectively, ensure that the project offers profit satisfying investors' minimum expected rate of return and there is an upper limit to the amount of profit. The sixth constraint ensures that the model is able to capture the payment priority. Lastly, there are several

constraints which are required to keep the decision variables non-negative. The optimization model is available for reference in section 5.5 of this report. For more details, readers are suggested to refer to Sharma (2010).

Using optimization techniques has several benefits. It increases transparency, improves accountability since the optimal solution cannot be manipulated, provides valuable information that maximizes the benefits to public by reducing costs and increasing benefits, maintains attractiveness of the project as an investment opportunity, allows capping the amounts of profit to the private sector, considers the effect of opportunity loss to the public sector due to the investment in the project which includes network effect of highways and future plans of the DOTs, and provides reliable information which helps in negotiating contractual terms, like profit sharing and equity sharing with the private sector.

5.3 Structure of Sensitivity Analysis and Optimization

Linear Programming (LP) is a branch of optimization where the objective function and all the constraints are linear. LP models are used when the decisions are dependent on multiple factors and when the best decisions cannot be reached by heuristic methods. Using LPs requires several inputs, a valid model, and MS Excel solver.

The LP model requires DSCR, total debt capacity, debt capacities of senior bonds, junior bonds, TIFIA, or any other bonds and debt service for each bond type; revenues under aggressive case and base case; minimum acceptable rate or return (MARR) for debt lending institutions, private investors and ALDOT; and long term plans of the department to estimate the opportunity loss coefficient as inputs. LP model can be developed incorporating these inputs as variables and can be easily implemented in MS Excel (refer section 5.5 for model). Optimization is carried out using Excel's inbuilt solver. However, the revenue streams variable is a random variable in the model. Hence, simulations were used to obtain optimal capital structure assuming the revenue streams to follow beta distribution.

INPUTS	PROCEDURE	OUTPUTS
Debt Financing Test Results Equity Financing Results Risk Factors	1 Estimate changes in risk factors 2 Conduct Sensitivity 3 Form the LP model 4 Solve LP Model 5 Interpret Results	Tornado Diagram Risk Impact and Sensitivity Optimal Capital Structure

Figure 5-1 Sensitivity Analysis and Optimization Process
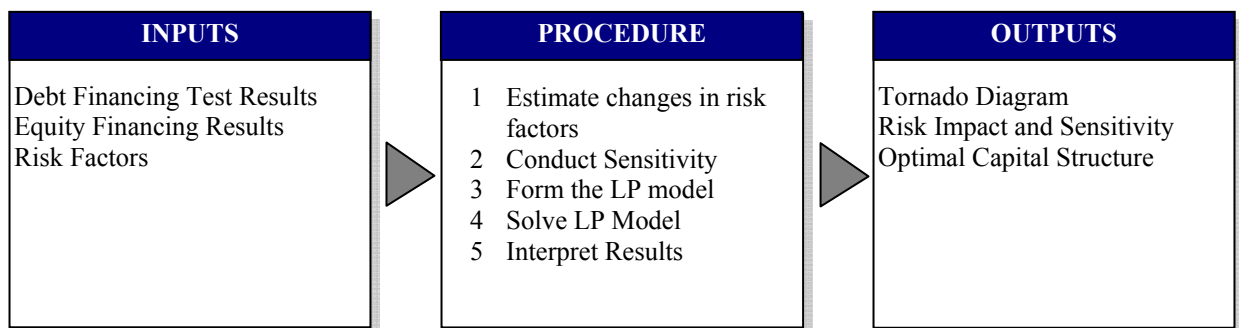
Tornado Diagrams are used to conduct one-way sensitivity analysis. This requires identification of factors which can influence the outcome of the model. The factors used for the sensitivity analysis of PPP finance model are traffic volume, traffic growth rate, DSCR, ramp-up period, senior bond yield, and project cost. These factors are varied one at a time to estimate the

variation on total bonding capacity and private equity. Tornado Diagrams are developed using built-in features of MS Excel. The Tornado Diagrams provide information on the effect of risk factors on debt financing capacity and private investment. The information can be effectively used to set priorities to address risks.

5.4 Analysis Process

- *Step 1 Identify the objective of the problem and influencing factors*

The process of optimization begins with analyzing the problem statement and identifying the objective of the problem. Generally in practice, the objective is to maximize the profit or to minimize the costs. In this project the objective is to calculate the optimal financial structure for the PPP setup. The factors that influence the optimal financial structure are total debt capacity, individual debt capacities bonds, debt service for each bond type, revenues under different scenarios, applicable minimum acceptable rate or return (MARR), and the opportunity loss coefficient.

- *Step 2 Develop Objective Function to Represent Objective of the Problem*

The objective is to maximize the benefits of the public agency, and a function needs to be developed that quantifies public interests. However, for computational reasons, the model was modified to minimize the department costs. Since debt, private equity, and public funds represent the financial structure of a PPP project, the costs of each financing source were included in the objective function. The difference between Debt Service and Debt represents the public costs through debt financing. Similarly, profit given to the private investors is to be minimized, hence variables representing private equity investment and corresponding profit were also included. Lastly, a reduction of upfront public investments may be beneficial to public agencies. These reduced upfront investments leave more money-in-hand to be used for other new or renovating jobs. By using public funds in a PPP project, the public agency essentially gives up the opportunity to build other infrastructure that could bring economic and social benefits to the public. Hence, a public opportunity loss coefficient γ is used to account for the opportunity loss due to the use of public funds in PPP projects.

- *Step 3 Develop Constraints*

The model requires all the constraints, which affect the objective function. In the case of PPP projects the debt capacity constraint defines the maximum amount of debt that a PPP project can support. The debt holders require that the debt service is secured with higher net revenue during the project operation phase. A reserve fund could also be used to pay debt service. The reserve fund is either from initial public or private investments or from operation profit reserves from earlier years. Third, PPP financing must be able to cover project costs. Fourth, the rate of return for private partners must be large enough to attract private investments, yet small enough to protect public interests. $i_{P(min)}$ and $i_{P((max)}$ indicate the lower and upper boundaries of the rate of return for private partners. Furthermore, profits to private partners must be paid after debt services are paid. Lastly, non negativity constraints are added to the model and are necessary for modeling reasons.
- *Step 4 Code it as MS Excel Model and using the inbuilt solver optimize*

The mathematical LP model is transformed to a working model by coding it as a LP model in MS Excel worksheet. MS Excel provides a built-in optimization solver, which can be easily invoked and used for optimization. The solver optimizes and gives an optimal financial structure. This gives us an optimal structure of debts, private equity, and public equity in the PPP financial structure, which promises minimum costs to the public sector. However, the model has several random variables, but the optimal structure obtained considers deterministic values for all the input variables.

- *Step 5 Simulate to account for uncertainty*

In PPP projects, revenues are uncertain. Hence, the Monte Carlo simulation was used to generate revenue streams following beta distribution. Beta distribution was adopted as it is a closed distribution, and it has been widely used in the construction industry to represent uncertainty. Macros are developed in the Excel Toolkit to generate random numbers with beta distribution and to run optimization cycles. Each cycle consists of four tasks:

- ❖ Generate Random Number With β Distribution
- ❖ Run Optimization
- ❖ Record Optimal Structure
- ❖ Generate Random Number With β Distribution

The results obtained from these cycles provide optimal financial structure under uncertainty.

- *Step 6 Interpret the results*

LP models provide the optimal capital structure. However, the results sometimes may be different from what the intuition suggests. Hence, it is necessary to interpret the results very carefully. Table 5-1 provides some results and explanation which might help in understanding the results from the optimization model.

Table 5-1 Optimization Results Explanation

Result	Possible Reason
Senior Bond = 0, TIFIA < Capacity, Private Equity = 0, Public Funds are unexpectedly very large	Project revenues may be inadequate to secure debt service and private equity.
Senior Bond < Capacity, TIFIA = Capacity, Private Equity = 0, Public Funds may be unexpectedly large.	Project revenues may only cover debt service, and equity cash flow is insufficient to attract private equity investment.
Senior Bond = Capacity, TIFIA = Capacity. Equity is divided into private equity and public funds.	Project revenues are sufficient to support debt financing and equity financing.
Senior Bond = Capacity, TIFIA = Capacity. Funding gap is closed only by public funds.	Project revenue streams are very strong and could be self financed.

Sensitivity analysis using Tornado Diagrams is a commonly used technique, but the process of developing a Tornado Diagram is not discussed here. However, when using the Tornado Diagrams, it is necessary to interpret the results carefully. For example, the Tornado Diagrams provide information like – if the DSCR is increased, the debt capacity decreases, which increases the chances of private investment in the project. If the revenues are increased, the total debt capacity for the project increases, but at the same time the private investment chances also increase.

5.5 Optimization Model

$$Max \quad (D - \sum_{t=0}^{T} \frac{DS_{(t)}}{(1+i_A)^t}) + (E_1 - \sum_{t=0}^{T} \frac{P_{1(t)}}{(1+i_A)^t}) - \gamma * E_2 \qquad \textit{(Maximizing Public interests)}$$

Subject to

$$D*DSCR - \sum_{t=0}^{T} \frac{DS_t}{(1+i_B)^t} \leq 0 \qquad \textit{(Debt capacity constraint-debt holder interests)}$$

$$DS_t*DSCR - (R_t + DSR_t - OM_t) \leq 0 \qquad \textit{(Debt service constraint-debt holder interests)}$$
$$C - (D + E_1 + E_2) \leq 0 \qquad \textit{(Minimal project funds constraint)}$$

$$E_1 - \sum_{t=0}^{T} \frac{P_{1(t)}}{(1+i_{P(\min)})^t} \leq 0 \qquad \textit{(Project attractiveness constraint-private interests)}$$

$$\sum_{t=0}^{T} \frac{P_{1(t)}}{(1+i_{P(\max)})^t} - E_1 \leq 0 \qquad \textit{(Cap on private equity return-public \& private interests)}$$

$$P_{1(t)} \leq R_t - OM_t - DS_t \qquad \textit{(Payment priority constraint)}$$
$$D, DS, E_1, E_2, P_1, P_2, \geq 0 \qquad \textit{(Non-negative constraint)}$$

Where,
   C = Construction cost
   D = Debt
   E_1 = Private Equity
   E_2 = Public Funds
   i_A =Rate of return for public agency
   i_B =Rate of return for debt holders
   i_P =Rate of return for private partner
   γ = Public Opportunity Loss Coefficient
   R_t = Revenue at time t
   DS_t = Debt Service at time t
   OM_t = Operation & Maintenance costs at time t
   DSR_t = Debt Service Reserve payment at time t
   P_{1(t)} = Profit Sharing for private partner at time t
   P_{2(t)} = Profit Sharing for public agency at time t
   DSCR = Debt Service Coverage Ratio

6 Evaluation Example

6.1 Project Information

The city of Montgomery remains highly congested during the rush hours. The majority of congestion is caused by freight, which increased after the development of Panama City International Airport. Due to its strategic location near a port, businesses in the region have increased using the corridor since 2005. This has significantly contributed towards the increase in the truck percentage passing through the City of Montgomery. Over the next 20-30 years, the truck percentage is expected to increase rapidly and the congestions of the city are expected to aggravate. Recent studies in the region also indicate that the city is attracting migrants from surrounding regions, which will also increase passenger car traffic considerably. In order to provide a bypass to the freight traffic, a new limited-access highway was proposed that would also improve connectivity of the city's road network with the interstate system in the southeast states.

Preliminary investigations revealed that the highway would be about 20 miles and would require about $208M to construct. Due to funding constraints, ALDOT officials wanted to see if the project could be developed through private investment. Officials in the Department believed that due to the high revenue potential of this project, private parties in real estate, advertisement, commercial operations companies, service industry, etc may be highly interested in investing and operating this asset. However the officials had questions, like

- Is it feasible to develop this asset through PPP?
- How much private equity can be expected and how much public sector needs to invest?

In order to get answers to questions like these, officials at ALDOT Headquarters unanimously decided to conduct a PPP Feasibility Analysis for this project.

6.2 Debt Financing Test

STEP 1 Estimate Project Capital Costs

Project Estimated Cost….   **$208.00** Million
    Other Sources : Project development plan, project cost estimates and
    preliminary analysis reports

STEP 2 Estimate Operating and Maintenance Costs

Assuming O & M Costs to be 20% of Project Estimated Cost….   **$41.60** Million
    (Source: IBI Group (2007))
    Other Sources :IBI Group (2007), WSDOT, Lindly (2003), ACPA and CDOT (2009)

STEP 3 Estimate User Fee Revenue

This requires estimation of ADT and toll rates.
ADT calculation is beyond the scope of this report. However these numbers are available from preliminary analysis. It is assumed that the DOT estimates ADT count as shown on the next page.

Toll Rates can be estimated using the formula

Adjusted Toll Rate = $[R_{car} \times (1-p) + R_{Truck} \times p] \times L \times [q + (1-q)/2]$

where,

R_{car} = Toll rates per mile for passeneger cars (varies between $0.09 to $1.01)

R_{Truck} = Toll rates per mile for trucks (varies between $0.31 to $2.33)

p = Truck percentage (varies between 5% to 13% for urban area)

q = pass through traffic percentage (depends on project)

L = length of the toll road in miles.

Assuming	R_{car} =	0.5	
	R_{Truck} =	1.5	
	p =	0.08	
	q =	0.15	
	L =	20	miles

Adjusted Toll Rate = 6.67

Table 6-1 Hyptothetical Revenue Streams

Year	ADT (Thousands)	Toll Rate	Revenue($1000)
2010	900	6.67	6003.00
2011	1420	6.67	9471.40
2012	1670	6.67	11138.90
2013	1818	6.67	12126.06
2014	1829	6.67	12199.43
2015	1837	6.67	12252.79
2016	1827	6.67	12186.09
2017	1856	6.67	12379.52
2018	1841	6.67	12279.47
2019	1857	6.67	12386.19
2020	1882	6.67	12552.94
2021	1899	6.67	12666.33
2022	1907	6.67	12719.69
2023	1910	6.67	12739.70
2024	1915	6.67	12773.05
2025	1939	6.67	12933.13
2026	1978	6.67	13193.26
2027	2013	6.67	13426.71
2028	2048	6.67	13660.16
2029	2090	6.67	13940.30
2030	2093	6.67	13960.31
2031	2097	6.67	13986.99
2032	2097	6.67	13986.99
2033	2100	6.67	14007.00
2034	2104	6.67	14033.68
2035	2107	6.67	14053.69
2036	2118	6.67	14127.06
2037	2118	6.67	14127.06
2038	2125	6.67	14173.75
2039	2125	6.67	14173.75
2040	2135	6.67	14240.45

When this data is not available the calculations can be done manually.
It requires initial revenues and growth rates for ramp up period. For example

Initial Revenue =   6000
Ramp Up Period Growth Rate =   6.0%   (which includes 2% of inflation in tolls)
Ramp Up Period =   5 years
Growth rate upto 30 years =   3.0%   (which includes 2% of inflation in tolls)

STEP 4 Estimate Other Revenue

Estimating revenue from other sources is dependent on project characterisitics. Some form of revenue may be received annually or periodically or only once. All these must be calculated and added to the revenue streams caluclated above.

STEP 5 Calculate Free Cash Flow

Free Cash Flow statements can be developed as shown in the following table (6-3)

STEP 6 Determine Debt Capacity Service Schedule For Senior Bonds

Assuming that the project is a greenfield project in outlying protions of the metro area
we select DSCR =   1.5

Debt service for senior bonds is calculated in Column F of Table 6-3 and is
obtained by dividing Column D with DSCR = 1.5.

STEP 7 Determine Senior Bonding Capacity

For a 30 year bond (source Yahoo Bond Centre on August 9, 2010)

A-rated Muni Bond yields an interest rate of   4.70%   and
A-rated Coprorate Bond yield interest at a rate of   6.10%

Hence we select the interest rate of between these limits
and we select   5.50%

In order to calculate the senior bonding capacity net present value must be caluclated. Hence Column G of table 6-3 calculates the yearly Present Value Interest Factors at 5.50%

Column H calculates the yearly present values of senior bond debt service. It is done by multiplying Column G with Column F. The senior bonding capacity is the summation of present values of senior bond debt service.

STEP 8 Determine Debt Service For TIFIA Bonding Capacity

It is assumed here that DSCR for TIFIA is   1.1

Calculate left over revenues after serving the senior debt. This can be done by calculating by using the formula (Free Cash Flow - Senior Bond Debt Service)/ TIFIA's DSCR

In Table 6-3 this is done by subtracting ColF from ColD and then dividing it by TIFIA's DSCR.

TABLE 6-2 Free Cash Flow, Senior Bonding Capacity & TIFIA Bonding Capacity

	Col A	Col B	Col C	Col D	Col E	Col F	Col G	Col H	Col I	Col J	Col K
Years	Capital Expenses	Gross Revenue	O &M Costs 20% of B	Working Capital ColB-ColC	Free Cash Flow Col (B-C-E)	Senior Bond Debt Service (ColD)/DSCR	PV Interest Factor	PV Senior Bond Debt Service ColF*ColG	Debt Service for TIFIA ColD-ColF	PV Interest Factor	PV TIFIA Debt Service ColI*ColJ
2007	69.3				-69.3						
2008	69.3				-69.3						
2009	69.3				-69.3						
2010		6.00	1.20	4.8	4.8	3.20	0.807	2.58	1.46	0.854	1.24
2011		9.47	1.89	7.6	7.6	5.05	0.765	3.87	2.30	0.822	1.89
2012		11.14	2.23	8.9	8.9	5.94	0.725	4.31	2.70	0.790	2.13
2013		12.13	2.43	9.7	9.7	6.47	0.687	4.45	2.94	0.759	2.23
2014		12.20	2.44	9.8	9.8	6.51	0.652	4.24	2.96	0.730	2.16
2015		12.25	2.45	9.8	9.8	6.53	0.618	4.04	2.97	0.702	2.09
2016		12.19	2.44	9.7	9.7	6.50	0.585	3.80	2.95	0.675	1.99
2017		12.38	2.48	9.9	9.9	6.60	0.555	3.66	3.00	0.649	1.95
2018		12.28	2.46	9.8	9.8	6.55	0.526	3.44	2.98	0.624	1.86
2019		12.39	2.48	9.9	9.9	6.61	0.499	3.29	3.00	0.600	1.80
2020		12.55	2.51	10.0	10.0	6.69	0.473	3.16	3.04	0.577	1.75
2021		12.67	2.53	10.1	10.1	6.76	0.448	3.03	3.07	0.554	1.70
2022		12.72	2.54	10.2	10.2	6.78	0.425	2.88	3.08	0.533	1.64
2023		12.74	2.55	10.2	10.2	6.79	0.402	2.73	3.09	0.513	1.58
2024		12.77	2.55	10.2	10.2	6.81	0.381	2.60	3.10	0.493	1.53
2025		12.93	2.59	10.3	10.3	6.90	0.362	2.49	3.14	0.474	1.49
2026		13.19	2.64	10.6	10.6	7.04	0.343	2.41	3.20	0.456	1.46
2027		13.43	2.69	10.7	10.7	7.16	0.325	2.33	3.25	0.438	1.43
2028		13.66	2.73	10.9	10.9	7.29	0.308	2.24	3.31	0.421	1.39
2029		13.94	2.79	11.2	11.2	7.43	0.292	2.17	3.38	0.405	1.37
2030		13.96	2.79	11.2	11.2	7.45	0.277	2.06	3.38	0.389	1.32
2031		13.99	2.80	11.2	11.2	7.46	0.262	1.96	3.39	0.374	1.27
2032		13.99	2.80	11.2	11.2	7.46	0.249	1.85	3.39	0.360	1.22
2033		14.01	2.80	11.2	11.2	7.47	0.236	1.76	3.40	0.346	1.17
2034		14.03	2.81	11.2	11.2	7.48	0.223	1.67	3.40	0.333	1.13
2035		14.05	2.81	11.2	11.2	7.50	0.212	1.59	3.41	0.320	1.09
2036		14.13	2.83	11.3	11.3	7.53	0.201	1.51	3.42	0.307	1.05
2037		14.13	2.83	11.3	11.3	7.53	0.190	1.43	3.42	0.296	1.01
2038		14.17	2.83	11.3	11.3	7.56	0.180	1.36	3.44	0.284	0.98
2039		14.17	2.83	11.3	11.3	7.56	0.171	1.29	3.44	0.273	0.94
2040		14.24	2.85	11.4	11.4	7.59	0.162	1.23	3.45	0.263	0.91
		Bonding Capacities				Senior Bonds=		**81.45**		TIFIA =	**46.77**

Total Bonding Capacity = Senior Bonding Capacity + TIFIA Bonding Capacity

=   81.45   +   46.77

=   **128.22**

In order to calculate the TIFIA debt capacity, net present value must be caluclated. This can be done by calculating the present value of TIFIA loans at TIFIA rate

On August 9, 2010, interest rate on TIFIA website was =   4.01%

Column J of table 6-3 calculates the yearly Present Value Interest Factors at 4.01%

Column K calculates the yearly present values of TIFIA debt service. It is done by multiplying Column I with Column J. TIFIA bonding capacity is the summation of present values of TIFIA bond debt service values in Col K.

STEP 9 Determine the Total Debt Capacity

Total Debt Capacity is the summation of Senior Bond and TIFIA loan.

As per Table 6-3 it is   81.45   +   46.77   = $128.22 M

STEP 10 Verify the Self Financing Ability Index

Self Financing Ability Index (SFAI) = Debt Capacity / Project Costs
SFAI =   0.62

Since the SFAI > .5 we can say that this project has the potential of being a PPP Project

Funding Gap for the project = $208.00   - $128.22
= $79.78

Hence the project must have Equity Financing of $80M

6.3 Equity Financing Analysis

STEP 1 Estimate Debt And Debt Service

This information is available from Table 6-4.

STEP 2 Develop Equity Cash Flows Under Base Case

Table 6-4 presents stepwise calculation of developing cash flow statements

Columns A, B and C are the same as in Table 6-3

Column D calculates EBITDA which means "Earnings Before Income Tax and Depreciation". It can be calculated by subtracting O&M Costs from Gross Revenues

Yearly depreciation of the asset is shown in Column E.

Values of Earnings Before Income Tax (EBIT) can be found in Column F and can be calculated by subtracting depreciation from EBITDA

TABLE 6-3 Equity Cash Flow Under Base Case

	Col A	Col B	Col C	Col D	Col E	Col F	Col G	Col H	Col I	Col J	Col K	Col L	Col M	Col N
Years	Capital Expenses	Gross Revenue	O &M Costs 20% of B	EBITDA ColB-C	Dep.	EBIT ColD-E	Debt Service Table 6-3	Interest Income	Income Before Tax Col F-G+H	Tax @30%	Net Income Col I-J	OCF ColK+E	Equity & Const. Profit	Equity Cash Flow s ColL-M
2007	69.3							6.24	6.24	1.87	4.37	4.37	23.93	-19.57
2008	69.3							4.16	4.16	1.25	2.91	2.91	23.93	-21.02
2009	69.3							2.08	2.08	0.62	1.46	1.46	23.93	-22.48
2010		6.00	1.20	4.8	6.9	-2.13	3.83		-5.96	-1.79	-4.17	2.76		2.76
2011		9.47	1.89	7.6	6.9	0.64	5.75		-5.11	-1.53	-3.58	3.36		3.36
2012		11.14	2.23	8.9	6.9	1.98	6.44		-4.46	-1.34	-3.12	3.81		3.81
2013		12.13	2.43	9.7	6.9	2.77	6.68		-3.91	-1.17	-2.74	4.20		4.20
2014		12.20	2.44	9.8	6.9	2.83	6.40		-3.57	-1.07	-2.50	4.43		4.43
2015		12.25	2.45	9.8	6.9	2.87	6.12		-3.25	-0.98	-2.28	4.66		4.66
2016		12.19	2.44	9.7	6.9	2.82	5.80		-2.98	-0.89	-2.09	4.85		4.85
2017		12.38	2.48	9.9	6.9	2.97	5.61		-2.64	-0.79	-1.85	5.08		5.08
2018		12.28	2.46	9.8	6.9	2.89	5.30		-2.41	-0.72	-1.69	5.25		5.25
2019		12.39	2.48	9.9	6.9	2.98	5.09		-2.12	-0.64	-1.48	5.45		5.45
2020		12.55	2.51	10.0	6.9	3.11	4.92		-1.81	-0.54	-1.27	5.67		5.67
2021		12.67	2.53	10.1	6.9	3.20	4.73		-1.53	-0.46	-1.07	5.86		5.86
2022		12.72	2.54	10.2	6.9	3.24	4.52		-1.28	-0.38	-0.90	6.04		6.04
2023		12.74	2.55	10.2	6.9	3.26	4.32		-1.06	-0.32	-0.74	6.19		6.19
2024		12.77	2.55	10.2	6.9	3.29	4.12		-0.84	-0.25	-0.59	6.35		6.35
2025		12.93	2.59	10.3	6.9	3.41	3.98		-0.57	-0.17	-0.40	6.54		6.54
2026		13.19	2.64	10.6	6.9	3.62	3.87		-0.25	-0.07	-0.17	6.76		6.76
2027		13.43	2.69	10.7	6.9	3.81	3.75		0.06	0.02	0.04	6.97		6.97
2028		13.66	2.73	10.9	6.9	3.99	3.64		0.36	0.11	0.25	7.18		7.18
2029		13.94	2.79	11.2	6.9	4.22	3.54		0.68	0.20	0.48	7.41		7.41
2030		13.96	2.79	11.2	6.9	4.23	3.38		0.86	0.26	0.60	7.53		7.53
2031		13.99	2.80	11.2	6.9	4.26	3.23		1.03	0.31	0.72	7.66		7.66
2032		13.99	2.80	11.2	6.9	4.26	3.07		1.18	0.35	0.83	7.76		7.76
2033		14.01	2.80	11.2	6.9	4.27	2.93		1.34	0.40	0.94	7.87		7.87
2034		14.03	2.81	11.2	6.9	4.29	2.80		1.49	0.45	1.04	7.98		7.98
2035		14.05	2.81	11.2	6.9	4.31	2.68		1.63	0.49	1.14	8.08		8.08
2036		14.13	2.83	11.3	6.9	4.37	2.56		1.80	0.54	1.26	8.20		8.20
2037		14.13	2.83	11.3	6.9	4.37	2.45		1.92	0.58	1.35	8.28		8.28
2038		14.17	2.83	11.3	6.9	4.41	2.34		2.07	0.62	1.45	8.38		8.38
2039		14.17	2.83	11.3	6.9	4.41	2.23		2.18	0.65	1.52	8.46		8.46
2040		14.24	2.85	11.4	6.9	4.46	2.14		2.32	0.70	1.63	8.56		8.56

Income from the project can be calculated by deducting all the debt services (calculated from Table 6-3 by adding columns H and K) and the interest income from the amount arranged for the project. This can be seen in column H.

In column I, Income Before Tax is calculated. This is done by subtracting debt services from EBIT and then adding the interest income.

Tax is calculated in column J at 30% and the net income in Column K by subtracting tax from income before tax.

The operating cash flows are calculated in column L by adding net income and depreciation.

Equity investment and the profit for equity investors can be found in column M.

The Equity Cash Flows can now be obtained by subtracting column M from column L. The Equity Cash Flows obtained in this way can now be used to calculate equity investment by private sector.

STEP 3 Estimate Equity Investment Under Base Case

Calculating equity investment follows the method discussed in STEP 7 and STEP 8 of Debt Financing Test. However since the MARR for private sector is not known the NPV of equity cash flows is calculated for a range of MARR. This range is selected such that it covers the MARR of the private sector.

Here a range of 0% to 30% is selected for MARR

Table 6-4 Returns to Private Sector at Different MARRs (Base Case)

MARR	NPV
5%	$19.34
10%	($15.75)
15%	($27.49)
20%	($31.33)
25%	($32.14)
30%	($31.68)

This indicates that if the private sector invests in the project, it will get returns in the range of 5% and 10% which is pretty low for private sector.

STEP 4 Develop Aggressive Case Scenario

In the case of aggressive approach of private sector the project may generate higher revenues. The private sector can adopt the following strategies which may generate more revenues. Since this is a hypothetical case, the effects of aggressive strategies are assumed here under reasonable limits and clearly mentioned in the following table.

Table 6-5 Private Sector Strategies and Effects

Strategy	Effect
Increase toll 5 cents for cars and 10 cents for trucks	Adjusted Toll Rate increased from $6.67 to $7.29
Attracted 2% more Trucks	Effective Toll Rate increased from 7.29 to 7.53
Tie up with TM-Mobile	Generated additional profit of $28M during the first year of operation.
Lease right of way to commercial businesses with 5 year leases.	Generate $4.95M every 5 years during the term of concession.

STEP 5 Develop Equity Cash Flows For Aggressive Case

Table 6-7 on the following page is the Equity Cash Flow Statement

Please Note that in Column N
      1. Overall revenue streams have increased compared to base case
      2. First year of operation is much higher than base case
      3. Every 5 years there is additional revenue

Table 6-7 Equity Cash Flow Statement Under Aggressive Case

Col A	Col B	Col C	Col D	Col E	Col F	Col G	Col H	Col I	Col J	Col K	Col L	Col M	Col N
Capital Expenses	Gross Revenue	O &M Costs	EBITDA	Dep.	EBIT	Debt Service	Interest Income	Income Before Tax	Tax	Net Income	OCF	Equity & Const. Profit	Equity Cash Flows
		20% of B	ColB-C		ColD-E	Table 6-3		Col F-G+H	@30%	Col I-J	ColK+E		ColL-M
69.3							6.24	6.24	1.87	4.37	4.37	18.96	-14.59
69.3							4.16	4.16	1.25	2.91	2.91	18.96	-16.05
69.3							2.08	2.08	0.62	1.46	1.46	18.96	-17.50
	6.78	1.36	5.4	6.9	-1.51	4.32		-5.83	-1.75	-4.08	2.85		**35.80**
	10.70	2.14	8.6	6.9	1.62	6.50		-4.87	-1.46	-3.41	3.52		3.52
	12.58	2.52	10.1	6.9	3.13	7.27		-4.14	-1.24	-2.90	4.03		4.03
	13.69	2.74	11.0	6.9	4.02	7.54		-3.52	-1.06	-2.46	4.47		4.47
	13.78	2.76	11.0	6.9	4.09	7.23		-3.14	-0.94	-2.20	4.74		4.74
	13.84	2.77	11.1	6.9	4.14	6.91		-2.78	-0.83	-1.94	4.99		**9.94**
	13.76	2.75	11.0	6.9	4.08	6.55		-2.47	-0.74	-1.73	5.20		5.20
	13.98	2.80	11.2	6.9	4.25	6.34		-2.09	-0.63	-1.46	5.47		5.47
	13.87	2.77	11.1	6.9	4.16	5.99		-1.83	-0.55	-1.28	5.65		5.65
	13.99	2.80	11.2	6.9	4.26	5.75		-1.50	-0.45	-1.05	5.89		5.89
	14.18	2.84	11.3	6.9	4.41	5.55		-1.15	-0.34	-0.80	6.13		**11.08**
	14.30	2.86	11.4	6.9	4.51	5.34		-0.83	-0.25	-0.58	6.35		6.35
	14.36	2.87	11.5	6.9	4.56	5.11		-0.55	-0.17	-0.39	6.55		6.55
	14.39	2.88	11.5	6.9	4.58	4.88		-0.30	-0.09	-0.21	6.72		6.72
	14.42	2.88	11.5	6.9	4.61	4.66		-0.05	-0.02	-0.04	6.90		6.90
	14.61	2.92	11.7	6.9	4.75	4.49		0.26	0.08	0.18	7.11		**12.06**
	14.90	2.98	11.9	6.9	4.99	4.37		0.62	0.19	0.43	7.37		7.37
	15.16	3.03	12.1	6.9	5.20	4.24		0.96	0.29	0.67	7.61		7.61
	15.43	3.09	12.3	6.9	5.41	4.11		1.30	0.39	0.91	7.84		7.84
	15.74	3.15	12.6	6.9	5.66	4.00		1.67	0.50	1.17	8.10		8.10
	15.77	3.15	12.6	6.9	5.68	3.81		1.87	0.56	1.31	8.24		**13.19**
	15.80	3.16	12.6	6.9	5.70	3.64		2.06	0.62	1.44	8.38		8.38
	15.80	3.16	12.6	6.9	5.70	3.47		2.23	0.67	1.56	8.50		8.50
	15.82	3.16	12.7	6.9	5.72	3.31		2.41	0.72	1.68	8.62		8.62
	15.85	3.17	12.7	6.9	5.75	3.17		2.58	0.77	1.81	8.74		8.74
	15.87	3.17	12.7	6.9	5.76	3.02		2.74	0.82	1.92	8.85		**13.80**
	15.95	3.19	12.8	6.9	5.83	2.90		2.93	0.88	2.05	8.99		8.99
	15.95	3.19	12.8	6.9	5.83	2.76		3.07	0.92	2.15	9.08		9.08
	16.01	3.20	12.8	6.9	5.87	2.64		3.23	0.97	2.26	9.19		9.19
	16.01	3.20	12.8	6.9	5.87	2.52		3.35	1.01	2.35	9.28		9.28
	16.08	3.22	12.9	6.9	5.93	2.41		3.52	1.06	2.46	9.40		**14.35**

STEP 6 Estimate Equity Investment for Aggressive Case

The method to estimate equity investment is the same as in STEP 3

When the NPVs are calculated the following results are obtained

Table 6-7 Returns to Private Sector at Different MARRs (Base Case)

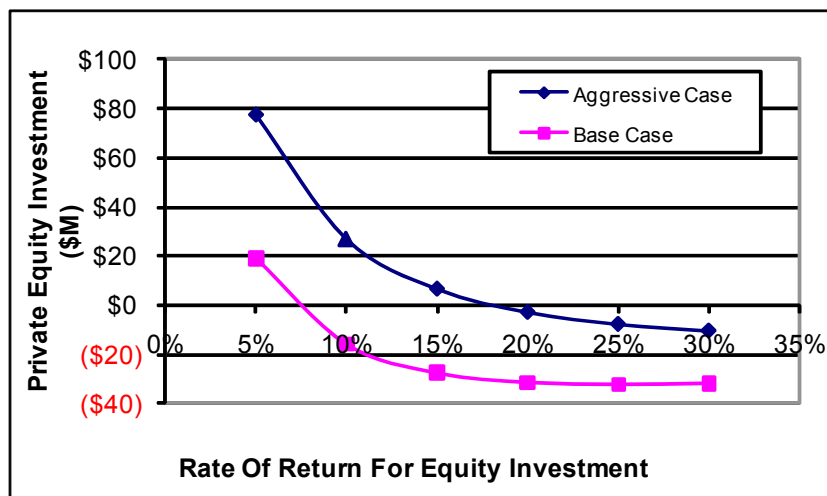| MARR	NPV
5%	$77.59
10%	$27.13
15%	$6.91
20%	($2.51)
25%	($7.40)
30%	($10.10)

Figure 6-1 Expected Equity Investment Under Base Case & Aggressive Case

STEP 7 Select MARR

Since the project is a greenfield project we select MARR = 15%

Step 8 Determine Equity Capacity

From Figure 6-1 it can be concluded that

Minimum Private Equity = $0.00

Maximum Private Equity = 6.91 ~ $7.00 Million

STEP 9 Identify Public Funds

The financial gap was $79.78 ~ $80.00 Million

Hence the public sector may have to invest something between $80 & $73 Millon

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Contact Information
University Transportation Center for Alabama
1105 Bevill Building
Box 870205
Tuscaloosa, AL 35487-0205
(205) 348-5658
(205) 348-6862 fax

utca@coe.eng.ua.edu
http://utca.eng.ua.edu

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