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I-70 East Corridor Project

Value for Money Report

December 2013



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Executive Summary

This value for money (“VfM”) analysis compares the total costs of delivering the I-70 East Corridor Project (the “Project”) using different forms of procurement. The objectives are to identify the procurement approach which:

- Best fits within Colorado Department of Transportation (“CDOT”) and Colorado Bridge Enterprises’ (“CBE”) Affordability Envelope for the Project;
- Results in the lowest net present value (“NPV”) of payments by CDOT and CBE over the lifecycle of the Project and maximizes availability of CBE revenues to fund additional, bridge replacement, and rehabilitation projects; and
- Creates the least risk to CBE’s AA- credit rating.

CDOT has selected three procurement options for detailed analysis:

- The Public Sector Comparator (“PSC”) is a Design-Build (“DB”) procurement financed by a TIFIA loan from US DOT and a senior bond issue by CBE both backed by a pledge of CBE’s revenues. Operations, maintenance, and rehabilitation (“OMR”) risks, and tolling revenue risks would be assumed by CDOT.
- Two Public-Private Partnership (“PPP”) procurement options are assessed. The first is a Design-Build-Finance (“DBF”) where the construction period is financed by the private sector partner and refinanced following substantial completion through a TIFIA loan from US DOT and a senior bond issue by CBE both backed by a pledge of CBE’s revenues. As in the PSC, OMR risks and tolling revenue risks would be taken by CDOT.
- The second is a Design-Build-Finance-Operate-Maintain (“DBFOM”) concession under which the private sector partner bears all the risks of the Project to a performance standard specified by CDOT. The private sector partner provides long-term equity, senior debt and TIFIA financing without recourse to CDOT or the CBE balance sheet except pre-defined annual availability payments which are subject to deductions for performance failures. OMR risks and tolling revenue risks could be taken by the private sector partner.

At this stage in project development, the VfM analysis is by necessity based on hypothetical estimates based on the features of the Project and experience drawn from similar projects. Best practice is for the VfM analysis to be used through the procurement process to ensure the details of the selected procurement approach are as efficient as possible. Under all procurement approaches, CDOT prefers a best value approach under which the Project is awarded to the private sector partner who can offer the maximum road improvements possible for a fixed budget in contrast to a traditional low bid approach.

DBFOM procurement does not require a significant cost contingency because the equity investors and lenders bear the risks of any cost overruns or schedule delays and obtain comfort through a completion support package comprising letters of credit and performance bonding which is significantly stronger than the requirements of DB contracting. As a result, DBFOM projects rarely, if ever, experience cost overruns which affect the public sector owner and are rarely delayed in completion.

Statistics in Australia and the UK, two nations with longstanding traditions of private investment in public infrastructure, show that 25% and 70% (respectively) of public sector projects finished behind time, whereas only 1.4% and 24% of PPP project finished experiences schedule overruns.¹ In the US, research has shown that only 47% and 55% of transportation projects delivered by the public sector were on budget and on time, respectively.

On average, PPP projects in the U.S. are approximately 15% less expensive than traditional public sector procurements, as evidenced by projects like the Denver FasTracks Eagle P3. For this project, the winning bid from Denver Transit Partners came out \$300 million below the Regional Transportation District’s (“RTD”) budget estimate and the first rail line is scheduled to open nearly a year ahead of RTD’s planned schedule.

In fact, DBFOM projects usually complete significantly earlier than DB projects. This is because the pressure of meeting the interest during construction (“IDC”) of the private sector partner’s lenders incentivizes the shortest construction schedule possible to obtain availability payments for performance as early as possible. Macquarie

¹ University of Melbourne, UK National Audit Office

estimates completion of the Project six months earlier under a DBFOM than a DB structure, based on precedents like FasTracks.

DBF procurement offers some of the same schedule benefits and equivalent cost and schedule certainty as a DBFOM. However, schedule efficiencies are constrained by limited flexibility in design.

CDOT's policy is to achieve 25-30% design before procuring a DB contract. This is essential because CDOT is taking the risk on the operations, maintenance, rehabilitation, and tolling over the long term. Under a DBFOM, these risks are transferred to the private sector partner and the level of design completed by CDOT should be at a conceptual level (~10%). CDOT's costs of monitoring construction performance will also significantly reduce (from the total of 16% of contract value in the Atkins estimate) as the risks of performance are monitored by the equity investors and lenders.

Greater design flexibility in DBFOM procurements leads to design innovation, whole of life cost optimization, and schedule efficiencies which significantly reduce the costs of DBFOM relative to DB.

This is particularly true in the current North American market place in which international contractors will bid DBFOM projects much more aggressively than the traditional North American contractors will bid DB projects where the international contractors are far less likely to participate. DBFOM procurement will therefore attract a broader, more innovative and more competitive market which will also force North American contractors to bid more aggressively.

Macquarie anticipates a 16.6% construction cost saving from DBFOM procurement relative to DB procurement. This is at the low end of recent experience in the PPP market in North American, in which cost differences between winning and losing bidders have been upwards of 20-25%. In most cases, the winning bidder that submits the lowest price is an international company, while the bidder that submits the highest price is a domestic firm that also participates actively in DB procurements. This trend is consistent with recent processes, such as the Ohio River Bridges – East End Crossing Project. On this project, an international contractor came in with the lowest price while a major U.S. contractor submitted a substantially higher and less competitive price (15-20% higher than winning bid).

In a DBFOM, the private sector partner brings together an integrated consortium which is responsible for the long-term performance of the system. The long-term contract performance payment mechanism is the key to providing a stronger, more effective means of optimizing the Project's lifecycle costs in a way that meets program and performance requirements. Operations and maintenance cost estimates were developed using a proprietary cost model comprised of four components: toll equipment costs, operating costs, rehabilitation costs, and administrative costs. The Shadow Bid used a "bottoms-up" approach to calculate individual unit costs, staffing costs and market prices for materials. The PSC assumptions for quantities of materials were held constant, with the variability being driven by the unit costs. Rehabilitation costs were estimated using the unit costs and segment data from the Shadow Bid. While our preliminary estimate is that the private sector partner could deliver OMR costs at 10-15% below the public sector, we have not factored these assumed savings in full into the VfM analysis and have assumed a more conservative reduction of 8% of OMR costs in the DBFOM relative to the PSC.

The effectiveness of managed lanes (and successful capture of associated tolling revenue streams) over the long term depends critically on effective design, operation, maintenance, and rehabilitation. Under a DBFOM, the private sector will typically take a more aggressive view on forecast tolling revenues and in accepting this risk, the private sector partner will be strongly motivated to operate, maintain, and rehabilitate the Project to a high standard.

Conclusion and Recommendations

DBFOM procurement is shown to result in significant benefits relative to a DB or DBF, including:

- Earlier completion;
- Transfer of specific project risk elements not fully captured in the contingency;
- Greater certainty and transparency of performance; and
- Additional taxes paid and economic activity generated by the private sector partner.

Further, DBFOM procurement will require a greater commitment from CDOT in respect of operations, maintenance and rehabilitation costs which will reduce CDOT's flexibility to defer maintenance costs in years of tight budgets. In addition, DBFOM procurement significantly mitigates risks to affordability and to CBE's credit rating relative to both DB and DBF procurement.

Based on these benefits and the VfM analysis completed by Macquarie, Macquarie recommends that CDOT proceed with DBFOM procurement.

1. Overview of Value for Money Methodology

A value for money (“VfM”) analysis compares the total costs of delivering an infrastructure project using different forms of procurement. Its purpose is to identify which procurement approach for a given project delivers the greatest value for the public sector. The VfM is a common practice to evaluate more traditional forms of project delivery including Design-Bid-Build (“DBB”) and Design-Build (“DB”) against Public-Private Partnerships (“PPP”) delivery which include private financing and/or transfer of responsibility for long-term operations, maintenance, and rehabilitation, such as Design-Build-Finance (“DBF”) or Design-Build-Finance-Operate-Maintain (“DBFOM”) structures.

This VfM will consider the estimated costs to the public sector of delivering the I-70 East Corridor project (the “Project”) using DB – which total estimated costs are known as the public sector comparator (“PSC”), against a PPP, using the same specifications, which total estimated costs are known as the Shadow Bid.

The PSC is an estimate of the hypothetical, whole-of-life cost of a public sector project if delivered by the Colorado Department of Transportation (“CDOT”) and has been developed in accordance with the required output specifications, the proposed risk allocation and is based on a DB structure, adjusted for the lifecycle risks of the Project over the whole of its life.

The Shadow Bid is based on the same scope and output specifications as the PSC, however contemplates the development and delivery of the Project under both DBF and DBFOM structures.

If the Shadow Bid is reasonably superior (assessed on both quantitative and qualitative criteria) to the PSC, then the Project should proceed with PPP delivery. If the Shadow Bids are not superior, then either the PPP delivery method will need to be refined to correct any weaknesses or the Project should not be delivered as a PPP.

This means CDOT will only choose a PPP delivery method if the capital and/or operating costs of the private sector in delivering the same level of service are lower than those of public sector delivery on a risk adjusted basis.

When comparing the options, the procurement approach that has the lowest cost – including lifecycle costs and risk – would deliver the most “value for money”.

Appendix A.1 contains a detailed discussion on the methodology of preparing a VfM analysis including the PSC and Shadow Bid.

2. Project Overview

2.1 Purpose and Objectives

The I-70 East corridor is one of the most heavily traveled and congested highway corridors in Colorado. The corridor serves a number of critical transportation functions including interstate and intrastate travel and the main route between Downtown Denver and Denver International Airport. Additionally, I-70 serves as a main access point to adjacent employment, neighborhood and new development centers.

The purpose of the Project is to implement a transportation solution that improves safety, access and mobility. The need for the Project results from the following issues:

- **Increased transportation demand** – the area is experiencing rapid growth and development including new development and redevelopment with substantial residential and business activity;
- **Limited transportation capacity** – the corridor serves a number of users including commuters, tourists, regional trucking and local traffic; the demand from these users is exceeding design capacity of the corridor;
- **Safety concerns** – the corridor experiences higher than average rates of traffic collisions further worsening conditions on the corridor and can be attributed to conditions that do not meet current design standards; and
- **Transportation infrastructure deficiencies** – I-70 was originally constructed in the early 1960's and was designed to last 30 years; several structures on the corridor are now past their anticipated lifespan and are classified as either structurally deficient or functionally obsolete and in need of replacement, rehabilitation or repair.

2.2 Project Scope

The Project includes the following elements:

- Add capacity in each direction;
- Lower highway between Colorado Blvd and Brighton Blvd; place a cover over the highway between Columbine Street and Clayton Street with urban landscape on top;
- North-south connectivity via York Street, Josephine Street, Columbine Street, Clayton Street, Steel Street/Vasquez Blvd, and Monroe Street;
- 46th Avenue located adjacent to the highway on each side;
- Add managed lanes in each direction to increase capacity;
- Managed lanes will be separated from general-purpose lanes by a striped buffer; and
- Pricing of managed lanes will be adjusted based on real-time demands.

Figure 1: Project Overview



2.3 “Best Value” Procurement Approach

CDOT wants to achieve a complete corridor solution for I-70; however, the cost of these improvements exceeds current funding availability making this unattainable without additional resources. Cost estimates produced several years before the tender date will only ever be indicative. Actual cost outcomes from the tender process may be significantly higher or lower than the forecast estimates depending upon the state of the Colorado construction market at the time of tender. Under all procurement options, CDOT has indicated a desire to compete the Project on the basis of the maximum road improvements possible for a fixed budget. This is in contrast to standard procurement which defines what is required to be constructed and then awards the contract to the partner who offers the lowest cost.

In order to follow this procurement approach, CDOT must:

- Define minimum mandatory requirements which must be constructed to make the project effective;
- Define a scope ladder of additional elements above the mandatory requirements; and
- Develop as objective as possible a scoring methodology for valuing additional elements over and above the mandatory requirements.

This method of procurement lends itself to DBFOM delivery but can also support DB and DBF procurement approaches. The reasons DBFOM procurement lends itself well to this "best value" contracting approach are:

- There is a close relationship between upfront construction and long-term OMR costs, which under a DBFOM are integrated into a single bid proposal; and
- Under PPP delivery, unlike public finance models, there is a close relationship between what is constructed and the financing.

A strong example of the contracting approach based on "maximum highway improvements for a defined budget" is the Sea-to-Sky Highway Improvement Project DBFOM in Vancouver, British Columbia. Scope ladders are now common "best practice" in Canadian PPP procurements. In the case of Sea-to-Sky, the owner received an additional 20 kilometres of passing lanes from the successful consortium, 33% more than required by the baseline improvements, so that 80 of the 99 kilometre highway has passing lanes. The winning bidder also delivered 16 additional kilometres with a median barrier and additional rumble strips than required delivered

under the baseline improvements. As well, additional highly reflective pavement markings and roadside reflectors, improved lighting and 10 kilometres additional wider shoulders (17% more than baseline) to improve and enhance safety was delivered under the model.

3. Financing Options

The aim will be to structure a financial plan for the Project that is robust, low-cost, and provides a high level of certainty. This will ensure that the financing solution provides the best value to CDOT.

3.1 Anticipated Financing Options

Based on the anticipated sources of funding, possible financing for the Project is expected to include a combination of:

- Bonds including Tax-Exempt Bonds (“PABs”);
- TIFIA financing; and
- Bank debt.

A financing structure supported by taxable or tax-exempt bonds would result in a bond issuance upfront to fund the Project costs. Bank debt on the other hand, is typically drawn overtime as Project costs are incurred during the construction period. Tax-exempt bonds in the form of PABs are available for state-sponsored projects that have received federal approval. Finally, TIFIA financing represents a highly cost-effective and flexible source of subordinated debt for surface transportation projects of national and regional significance.

Based on the characteristics of the Project, the anticipated ideal financing structure for the Project is envisioned to include a combination of bonds and TIFIA financing.

3.2 Capital Markets and Tax-Exempt Financing (PABs)

3.2.1 Key Benefits / Issues associated with Bond Financing

Benefits:

- Tax-Exemption Pricing Advantage: PABs are exempt from federal income tax resulting in a lower bond yield vs. taxable bonds.
- Tenor / Average Life: Capital markets typically offer longer tenors than the bank market (eliminating refinancing risk).
- Broad Investor Market: The substantial market for rated securities can comfortably absorb a large transaction with an investor base comprising large bond funds, insurance companies, asset managers and mutual funds.

Key Issues:

- Negative Carry: The bonds issued upfront at financial close to fund the Project costs are deposited into an account until they are required to make construction payments. This creates some negative carry inefficiency as the deposit interest rate earned on the cash is lower than the interest rate paid on the bonds.
- Investment grade ratings from at least one nationally recognized rating agency. Construction risk will be a key risk in the assessment for the rating agencies on the Project.
- Requires a well-established and fully developed marketing and sales effort to maximize investor receptivity to any issuance.

3.2.2 Tax-Exempt Bonds (PABs)

Based on the details provided by CDOT, the Project will be eligible for PABs financing. PABs allow the private sector to issue tax-exempt bonds for surface transportation projects, accessing the very deep and liquid US tax-exempt investor market. Because PABs are exempt from federal income tax, the tax exempt rate generally provides the lowest cost of debt (typically 10-15% lower than taxable for long-term debt).

As with a taxable bond issuance, a PABs issuance would require an investment grade rating from at least one nationally recognized rating agency. As a result, the level of construction and OMR risk will be a key consideration in the assessment of the Project by rating agencies.

On the capital payment side, the reduced level of CBE funding available for the Project during 2026 to 2041 when the existing BABs debt service is highest will result in a u-shaped availability payment.

3.3 TIFIA Financing

TIFIA financing represents a highly cost-effective and flexible source of subordinated debt funding provided by the Transportation Infrastructure Finance and Innovation Act (“TIFIA”) program to support surface transportation projects of national and regional significance. TIFIA financing is typically provided in the form of a fixed rate subordinated secured loan to fund “Eligible Project Costs” and is generally provided for a maximum term of 40-years. The interest rate on a TIFIA loan is calculated by adding one basis point to the SLGS rate as published on the execution date of the loan.

Benefits of TIFIA Financing

Like a bank debt facility, TIFIA financing allows for funds to be drawn as needed, reducing the upfront funding required for a project. In addition, due to the subordinated nature of TIFIA, TIFIA financing allows for a higher coverage margin on senior debt, improving the credit rating of a project. Finally, TIFIA has flexible repayment terms and can be prepaid in part or in whole at any time without penalty.

Complexities Associated with TIFIA Financing

While TIFIA represents a highly cost-effective form of financing, complexities associated with TIFIA financing include:

- TIFIA requires (i) an investment grade rating from a nationally recognized rating agency on the senior debt and a rating on the TIFIA loan; or (ii) an investment grade rating on TIFIA, to the extent that the TIFIA loan amount exceeds the senior debt amount, as required by the TIFIA program.
- For projects using both a TIFIA loan and bond debt, the proceeds of the bonds are received at financial close while the proceeds of the TIFIA loan will typically be drawn only as required. As a result, inter-creditor terms defining how project risks are shared between investors become a critical issue for projects supported by TIFIA loans.
- For projects using both a TIFIA loan and a bank loan, the TIFIA Program requires minimum credit ratings from banks providing loans and interest rate swaps. Since the financial crisis, many financial institutions fall below the rating level required by the TIFIA program.
- Because the TIFIA amount available for draw is calculated on a rolling (cash) basis, the ability to drawdown on TIFIA funds relative to the TIFIA amount applied for is affected by the eligible cost draw curve. As a result, TIFIA financing can only be utilized in a period if the rolling maximum amount of TIFIA financing available (calculated as 33 percent of the total eligible costs incurred to date less the total TIFIA amount drawn to date) is higher than the financing requirement for the period. This means that the total amount of TIFIA financing that can be used to support the project is the minimum of: 1) the TIFIA amount applied for (based on 33 percent of estimated eligible project costs); 2) 33 percent of actual eligible project costs; and 3) the rolling maximum amount of TIFIA financing available.

Due to the above mentioned complexities, managing the TIFIA Program during the bid process in a full DBFOM procurement will be an important element in obtaining full value.

3.4 Bank Debt

Bank debt typically allows for a project to raise short, and potentially, medium or long term, LIBOR-based financing that can be partially or fully hedged to fixed rate funding as required.

The bank market provides an additional source of financing and the bank market is well acquainted with the risks typical to the Project. Furthermore, unlike a capital markets solution, a bank loan facility will not require a rating from the nationally recognized rating agencies.

In a typical DBFOM, the private sector will run a parallel process for bank financing (typically in the form of an underwritten or clubbed bank loan facility based on a negotiated senior debt financing term sheet), resulting in competitive pricing and loan terms. With respect to the Project, we do not anticipate that a senior bank debt facility would be the optimal solution for a full DBFOM given the availability of TIFIA Financing.

In the DBF scenario, the shorter term period associated with bank debt and prepayment flexibility could increase the attractiveness of a bank solution relative to a bond issuance (although a shorter term bond issuance would also be a possibility).

3.5 Equity

The DBFOM model will also require equity investment to cover the performance risk being transferred. There is a well established market for equity investment in performance based availability procurements. Lenders typically require equity of 10% of total private sector funding. Return requirements are typically an Internal Rate of Return on a cash-on-cash basis of 11-12% p.a. These are the target parameters used in Macquarie's modelling. The equity returns may increase and leverage fall if tolling revenue risk is also transferred to the private sector partner.

4. Funding Sources and Availability

The starting point for the VfM analysis is to establish the funding sources available for the Project and the Affordability Envelope which these create.

4.1 Long-term Funding

CDOT receives annual revenue from federal and state transportation funds. State funds are derived from the Highway Users Tax Fund (“**HUTF**”), which includes motor fuel taxes and vehicle registration fees. These funds support CDOT’s core functions of maintaining and expanding Colorado’s highway system, as well as distributions to County and Municipal Governments.

Colorado Bridge Enterprises (“**CBE**”) was formed in 2009 as part of the FASTER (“**Funding Advancement for Surface Transportation and Economic Recovery**”) legislation. The CBE generates revenue from a bridge safety surcharge on vehicle registration based upon vehicle weight. The Transport Commission annually allocates to the Bridge Enterprise the authority to receive additional federal funds toward the CBE.

The CBE is expected to be the primary funding vehicle for the capital costs of the Project. However, as noted below CBE revenues are unlikely to be available to support operation, maintenance, and rehabilitation costs of the completed Project. These costs will need to be met by CDOT from other sources. This will likely necessitate splitting of any payment mechanism into a capital portion and an operating portion. This is further described in Section **Error! Reference source not found.** and **Error! Reference source not found.** below.

In 2010, the CBE issued \$300 million in Build America Bonds (“**BABs**”) and has dedicated those funds to projects throughout the State.

4.2 Risks to Affordability

The major risks to Affordability at this stage are:

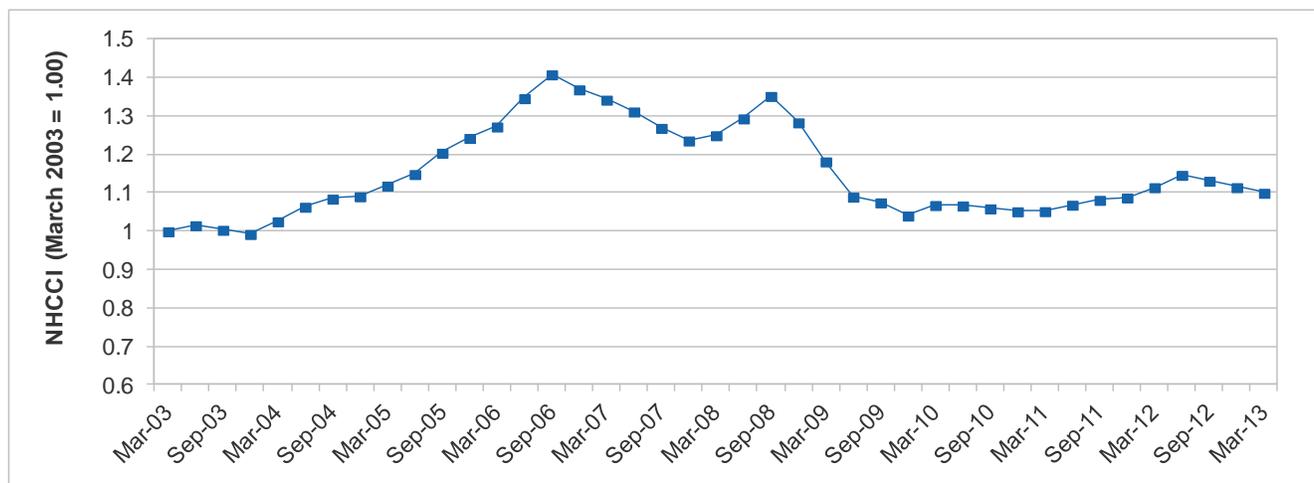
- Cost estimate increases;
- Cost overruns;
- Interest rate risk;
- Sources of funding for operations and maintenance costs; and
- Ratings issues and credit support.

Each of these risks are addressed in turn below.

4.2.1 Cost Estimate Increases

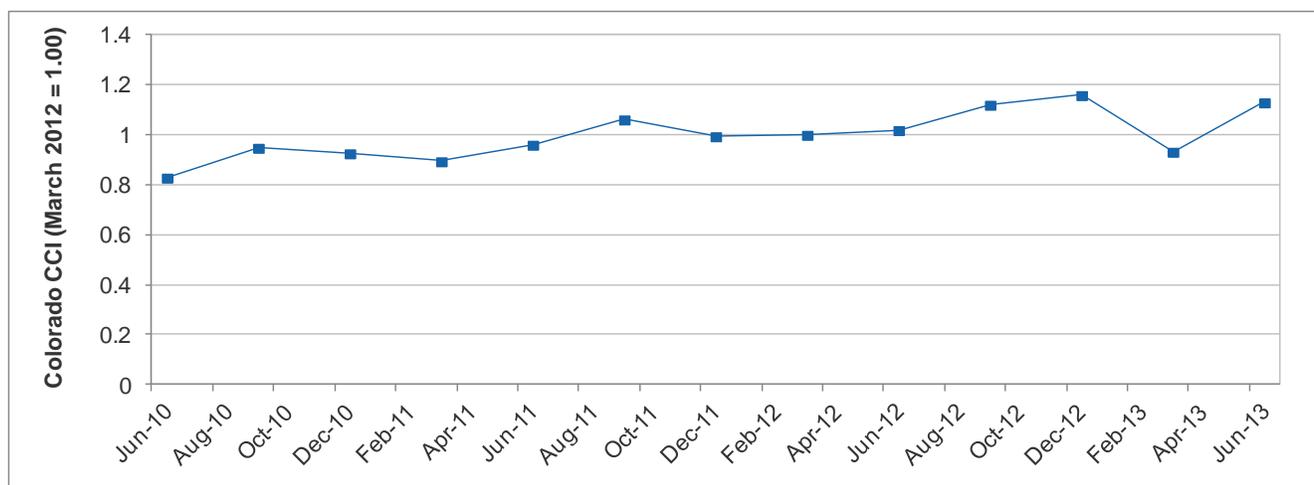
An important element of cost estimate increases is inflation in construction and materials cost indices. The National Highway Construction Cost Index has evidenced deflation for the past 3 quarters and is now at the lowest level since 2011.

Figure 2: National Highway Construction Cost Index



Colorado specific construction cost indices do not show the same decline and indicate some inflationary pressure. The outlook for the market both over the next two years prior to contract award and looking forward to the end of the construction period will have a significant effect on the competitiveness and affordability of bids.

Figure 3: Colorado Construction Cost Index



4.2.2 Cost Overruns

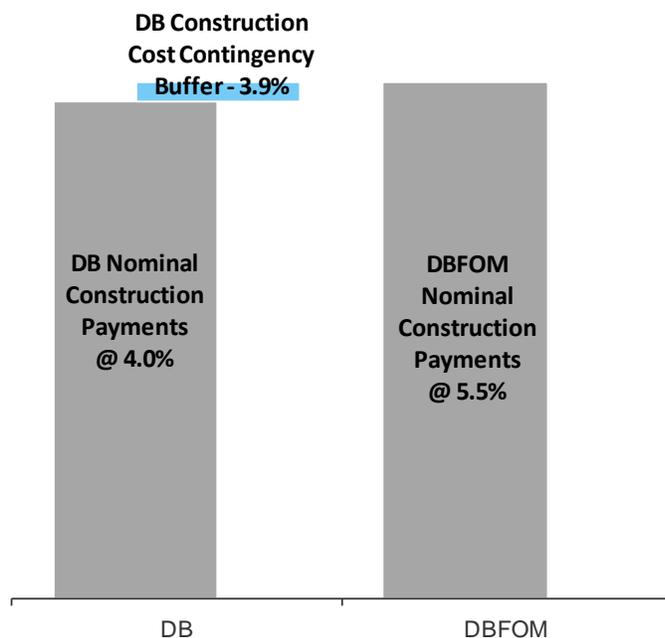
In contrast to cost estimate increases which will be known before award of the contract, cost overruns are increases following award. Given the transfer of construction risk to the private sector partner under DBFOM, CDOT will effectively be largely immune to any cost overruns under the DBFOM model. However under the DB model, CDOT will be at risk for any cost overruns by the contractor.

Assuming equal real construction costs, the DBFOM would eclipse the DB in terms of construction cost due to the higher cost of capital. When calculating the effect of the cost of capital difference, one would gross up the real construction cost according to the construction S-Curve. This value would represent the value at the end of the construction term that the party would need in order to achieve the initial construction cost on an NPV basis.

Since the DBFOM Weighted Average Cost of Capital (“**WACC**”) is greater than that of the DB, the total cost to construct the Project would be greater assuming equal construction costs. This gap created due to the cost of capital differential between a DB and DBFOM is partially covered by the increased real construction costs that are historically found in DBs relative to DBFOMs.

As seen in the figure below, an increase in construction costs of 3.9% would eliminate the cost of capital differential between the DB and the DBFOM models. As discussed further in Section 8, a cost overrun of this scale would be well within the range of experience for projects of this size and complexity.

Figure 4: Construction Cost Comparison



- DB Nominal Construction Payments @ 4.0% (All-in cost of the DB financing which includes both bond and the lower cost TIFIA indebtedness).
- DBFOM Nominal Construction Payments @ 5.5% (DBFOM WACC at 90/10 debt-to-equity ratio and 12% IRR).

4.2.3 Interest Rate Risk

A significant risk is an increase in interest rates before financial close.

Interest rates are expected to increase by end 2014 (Source: JP Morgan analysis). This increase would reduce the amount of construction cost which would be affordable but a potential advantage of a public finance procurement is that the bond issue could be launched early ahead of the launch of the project procurement.

However, negative carry on the early drawdown of funds would likely offset the benefits of locking in interest rates early and this approach would make it more challenging to integrate the TIFIA financing (which is dependent upon project details) with the senior debt issuance.

Furthermore a DBF scenario, will envision the issuance of a short-term bond to fund construction costs which would be refinanced through a long-term Senior and TIFIA debt issuance at completion of construction. This delay in the issuance of long term debt will likely result in the long-term cost of financing achieved by the Project partially eroding any cost of capital advantage the DBF would have over the DBFOM.

4.2.4 Sources of Funding for OMR

Experience suggests that without a dedicated and committed funding source, there is often pressure to defer maintenance and rehabilitation work in periods of budgetary pressure. Such deferral will typically result in higher and less predictable overall lifecycle costs which could put pressure on affordability.

4.2.5 Discount Rate

An important consideration in the quantitative analysis of procurement options is the choice of discount rate. The discount rate reflects the time value of money as well as any risk premium associated with a project, and is determined based on the project's risk profile and prevailing market conditions. Discounting enables nominal project cash flows² that differ in terms of timing and amount to be discounted back to a common reference date, usually to their present value. Discounting in this way allows procurement methods with different cash flow impacts to be compared on a "like-for-like" basis. Comparing competing options in this way provides an objective means of determining the approach that provides the best value in terms of cost.

There are a number of problems that can result from the selection of an inappropriate discount rate. A discount rate that is too low may make it unrealistic for the Shadow Bid delivery to ever beat the PSC. This can be managed by adding a risk premium to costings under the PSC, while a discount rate that is too high may make it too easy for the private sector partner to beat the PSC hurdle.

The choice of discount rate can skew bids. If the discount rate selected is too low, bidders will be incentivized to front end payments. If it is too high then CDOT will risk paying more than it needs to.

There is a debate over whether to use real or nominal rates. The major advantage of real rates is that they are a stable basis for fixing the discount rate over a long period of time.

The UK has typically used a discount rate of between 6-8% real for analysis of the PSC. This is neither the cost of public sector borrowing nor any calculation of the private sector partner's WACC. Instead it reflects a risk adjusted rate based on opportunity costs of public sector borrowing. The real rate of 8% was used to evaluate the first four shadow toll roads in the UK. This was then reduced to 6% real when the savings from these roads based on the successful bids were perceived to be unreasonably large. However, the problem remains that the public sector cost of borrowing reflects the entire portfolio of government assets, liabilities and revenue streams, whereas the private sector partner will be borrowing based on the specific revenue stream of the project.

4.2.5.1 Discount Rate Selection

There is considerable debate as to which discount rate should be used when developing the PSC and evaluating bids. Potential rates include:

- The estimated long-term cost of funds by CBE which is used to discount both the PSC risk adjusted and the private sector cash flows;
- A risk adjusted rate which reflects both CBE's cost of capital and the risk of the Project; or
- The full estimated private sector WACC for the Project (Recommended).

Long-term Cost of Funds

Some jurisdictions use the public sector's estimated long-term cost of funds to discount their PSC because the PSC incorporates discrete adjustments for risk in the model's numerator cash flows. Since cash flows rather than the discount rate are adjusted to reflect risk, both the PSC's risk-adjusted cash flows and the private sector cash flows could be discounted by CBE's long-term cost of funds.

Macquarie does not recommend this approach as the use of CBE's cost of capital would result in a cost of capital advantage that would indicate that CDOT should theoretically take on all public and private projects.

Risk Adjusted Discount Rate

The risk adjusted discount rate is calculated to incorporate the risks inherent to the project into the discount rate. To calculate the risk adjusted discount rate, a debt "guarantee" premium reflecting the margin between the expected project credit rating and the CBE's credit rating should be added to the public sector cost of borrowing. The adjusted public sector cost of capital factors out the implicit government guarantee on the debt so that it is comparable on a stand-alone basis.

² Nominal cash flows reflect the anticipated impact of inflation and/or construction escalation on the periodic costs of the project.

The project discount rate is not easy to calculate, however an assessment can be made of the cost of debt at the likely credit rating of the project, on a stand-alone basis, compared to the cost at CBE's rating. It is important to note that the structure of the debt (term, amortization, coverage ratios, reserves) is at least as significant as the actual cost. When calculating the risk adjusted discount rate, the cost of equity is not adjusted because it reflects the risk of the Project. In most circumstances this adjusted overall cost of capital should be close to the estimated WACC in the Shadow Bid.

While the use of a risk adjusted discount rate is recommend over the use of CBE's cost of capital, it still does not represent a like-for-like risk comparison.

Private Sector WACC

There is a strong argument that the PSC should be based on the full private sector WACC. For example, for road projects, Macquarie would argue strongly that the public sector discount rate should equal the private sector WACC. This is because payment timing drives risk transfer and because the WACC represents the best market proxy for the risk of the project. If a low discount rate is used then it incentivizes payment as early as possible in the project to achieve the lowest cost at the expense of effective risk transfer. Use of the WACC encourages the most efficient optimization of project risks.

Macquarie would recommend the use of the private sector WACC as it reflects the ideal risk-return relationship effectively portraying the inherent retained risk in the project from the governments standpoint.

5. Procurement Options

In this VfM, the DB approach (the PSC) is compared against both the DBF and DBFOM structures. Each of these procurement options, and key transaction considerations, are introduced and discussed below.

5.1 Procurement Models

5.1.1 Design-Build

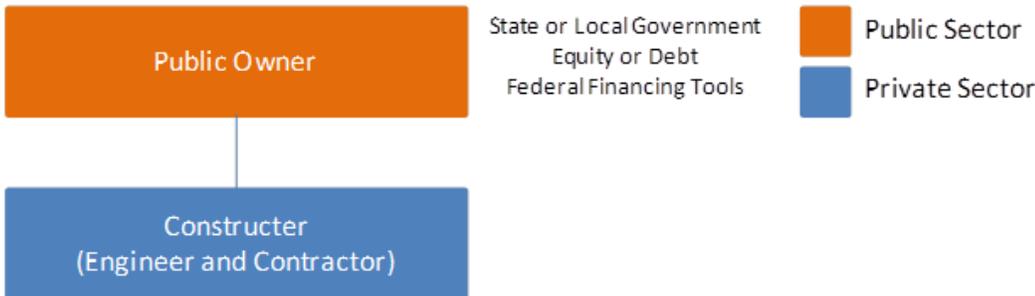
Under a DB structure, two usually separate services are combined into a single contract in which CDOT would execute a single, fixed-fee contract with the contractor for the design and construction of the Project.

Prior to procurement, CDOT’s policy is to complete between 25-30% of design, this level of design is not as fully developed as the design documentation that would be required for a construct-only contract. CDOT will also need to provide significant project definition in order to prepare bid documents to put out to tender.

The contractor would be responsible for the majority of design work and all construction activities. Warranty periods for the construction work can also be considered as part of CDOT’s contractual structure. CDOT would retain responsibility for financing, and operations, maintenance, and rehabilitation of the Project after construction is completed.

The following figure illustrates the contractual relationship in a DB contract.

Figure 5: DB Contractual Relationship



In the case of the Project, a DB structure would be financed by a public CBE bond offering.

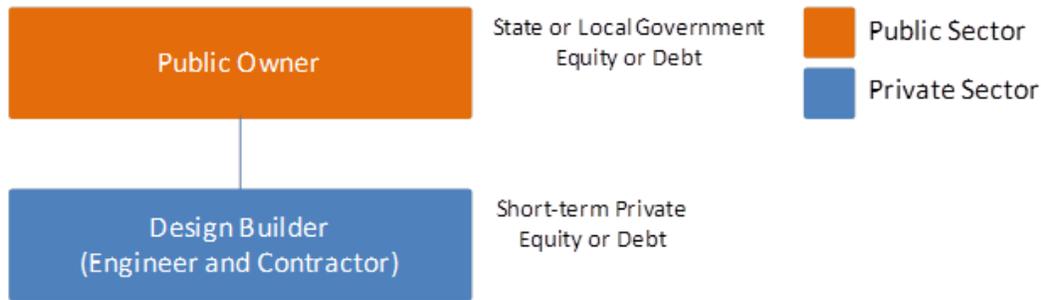
There have been numerous examples of DB projects in the United States. For example, the \$487 million Denver Union Station redevelopment, which is scheduled for completion in Spring 2014 and the \$3.25 billion Central Texas Turnpike System, SH130 Segments 1-4 have utilized a DB approach. Additional projects are listed in Appendix A.2.

5.1.2 Design-Build-Finance

A DBF model is similar to a DB with an added element of finance. A single contract is awarded by CDOT for the design, construction and full or partial financing of the Project during construction. CDOT would retain responsibility for operations, maintenance, rehabilitation, and life-cycle risk of the Project after construction is completed.

The following figure illustrates the contractual relationships in a DBF contract.

Figure 6: DBF Contractual Relationship



Similar to the DB approach described above, CDOT would need to complete between 25-30% of design, and provide significant project definition in order to prepare bid documents prior to tender.

In a DBF, the private partner assumes additional risks beyond those of a traditional DB contract by accepting a deferred payment. In addition, the lenders and equity provide additional oversight and monitoring during construction, which helps to drive performance in a DBF relative to a DB.

In the case of the Project, this model can be attractive to help CDOT address any cash flow constraints and/or to defer payment over the construction period, as a DBF project would be financed by the contractor.

There have been numerous examples of DBF projects in the United States including the \$402 million I-4/Selmon Expressway Connector in Tampa, Florida, and the \$425 million I-75 Roadway Expansion in Florida. Additional projects are listed in Appendix A.2.

5.1.3 Design-Build-Finance-Operate-Maintain

Under a DBFOM structure, CDOT would enter into an agreement with the private sector partner who would be required to design, build, finance, operate, maintain, and rehabilitate the asset over the specified term of the agreement.

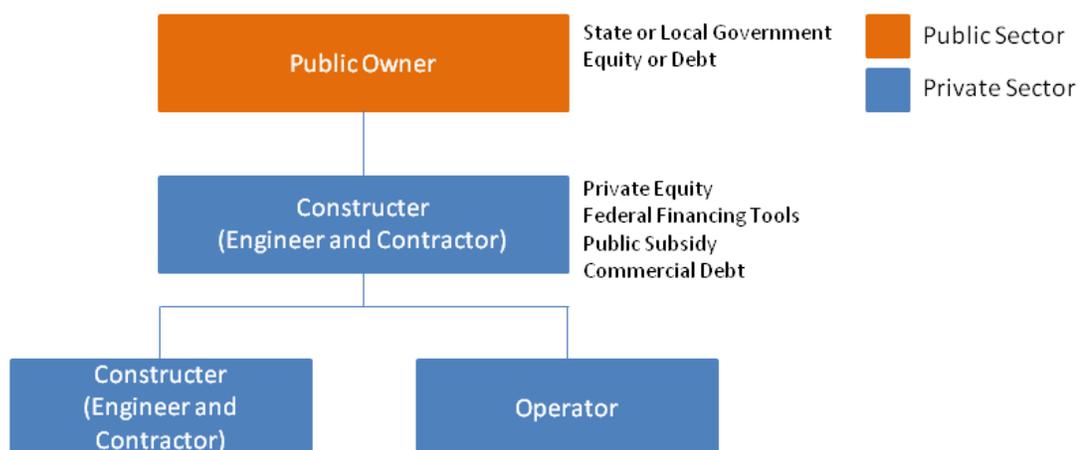
The DBFOM approach provides for full integration of design, construction, financing, operational, maintenance, and rehabilitation responsibilities. As the DBFOM model transfers the life-cycle cost risk from CDOT to the private sector partner, it also encourages efficient design and quality construction and finishes as responsibility and cost risk lies with the private sector partner for the long-term operations and maintenance. A DBFOM approach requires the bidders to consider long-term maintenance requirements and provides a financial structure that aligns the incentives of the private sector partner with CDOT.

In contrast to a DB or DBF, a DBFOM is best tendered at a conceptual (~10%) level of design. Performance specifications should be set by CDOT for the performance of the design, the construction, the operation, the maintenance and the rehabilitation of the assets for the Project as these are crucial to the proper function of any asset in any type of procurement. However, in the case of a DBFOM it is important for the public sector to carefully distinguish between output specifications (typically based on performance) and design, construction, operations and maintenance requirements (typically dictating the methods to use, the materials to use, the schedules, etc.).

For a DBFOM procurement, CDOT should focus on overall performance in order to give the private sector partner as much room as possible to use innovations in reaching the performance specifications in the most efficient manner, therefore resulting in better economics for all parties. A conceptual design, instead of a more developed 25-30% design, helps to achieve this.

The following figure illustrates the contractual relationships in a DBFOM contract.

Figure 7: DBFOM Contractual Relationship



5.2 Risk Transfer and Procurement Options

Although several procurement options can transfer similar risks, the effectiveness of the risk transfer varies with the amount and nature of the responsibility assumed by a private sector partner. For example, DB, DBF, DBFOM all have a design component, however, the transferred risk of design functionality would be greater for a longer term contract such as a DBFOM, where the party is responsible for the asset performance over a 20-to 40-year period. In contrast, a DB arrangement may have a warranty period of only three to five years, thereby reducing the opportunity for risk transfer.

In addition, greater risk transfer can be achieved by transferring risk across a broader range of activities. For example, in a DBFOM, the private sector partner would assume risk across key areas including design, construction, finance, operations, maintenance, and rehabilitation, whereas a DB arrangement would transfer mainly design risk through a more limited range of activities over a shorter term warranty.

Improved value from this type of risk transfer is achieved when the party taking responsibility for a particular activity is better able to manage the associated risks (i.e., the likelihood of the risk occurring is reduced, or the expected cost if the risk does occur is reduced), and when the ability to manage the risk is supported by the added incentive of a long-term, fixed-price, performance-based contract, which includes a payment mechanism with clauses to specifically transfer identified risks to a private sector partner. Establishing a maximum payment, contingent on effective management of these risks by the private sector partner, also adds value by providing greater planning certainty for CDOT.

5.3 Market Response to Procurement Options

Based on Macquarie’s analysis of the current construction market in the United States, it is anticipated that there will be a significantly different market response to the different procurement options:

- A DB is likely to primarily attract large domestic contractors,
- A DBF is likely to attract a similar pool of firms as a DB; however, the size of the pool would be limited by a firms’ ability to finance the project
- A DBFOM is likely to attract a wider pool of participants including international contractors and developers

It is important to note that the construction firms that would likely participate in a DB and DBF would also likely participate in a DBFOM. However, firms that are attracted solely by a DBFOM may not be attracted to a DB or DBF. Local contractors acknowledge that PPPs represent a growing market and it would be beneficial for them to demonstrate experience working in these transactions. Therefore, it is expected that they will pay close attention to DBFOM procurements and be more incentivized to participate in a DBFOM than a DB.

Also, due to the aforementioned benefits of the DBFOM to the contractor, gaining PPP credentials and experience is vital for international contractors and domestic contractors alike. DBFOM projects require greater

involvement from the senior management of the companies than in a DB and most of the time, the companies key individuals are allocated to PPP pursuits.

Bidding teams do not enter into DBFOM tenders and competitions lightly. They are usually comprised of multiple independent companies in consortia and will typically incur tens of millions of dollars of internal and external costs to submit their proposals. A comparison of the differences between winning and losing bids is therefore highly instructive. In general, the North American market has seen consistent differences for heavy civil infrastructure projects of in excess of 20%, which is further detailed in the Section 8, Construction Pricing. Differences in construction costs for vertical building projects (social infrastructure) tend to be smaller, in the 10-15% range, as the opportunities for significant design variations are not as great and there is even greater incentive in buildings to invest more in upfront construction to reduce operating and maintenance costs later.

6. Development and Transaction Costs

6.1 Preliminary Design Costs

The design requirements prior to tender are significantly different between DB or DBF and a DBFOM procurement. Consistent with CDOT's current practises, a DB or DBF procurement will require 25-30% design complete before tender and award.

In contrast, a DBFOM is best tendered at a conceptual (~10%) level of design. Performance specifications should be set by CDOT for the performance of the design, the construction, the operation, the maintenance, and the rehabilitation of the Project as these are crucial to the proper function of any asset in any type of procurement. However, in the case of a DBFOM it is important for CDOT to carefully distinguish between output specifications (typically based on performance) and design, construction, operations and maintenance requirements (typically dictating the methods to use, the materials to use, the schedules, etc.).

For a DBFOM procurement, CDOT should focus on overall performance in order to give the private sector partner as much room as possible to use innovations in reaching the performance specifications in the most efficient manner, therefore resulting in better economics for all parties. A conceptual design instead of a more developed 25-30% design helps to achieve this.

6.2 Procurement Schedule

As discussed above, the greater level of design work necessary before a DB procurement can be launched generally means that DBFOM can launch procurement earlier. However following launch, the procurement schedule associated with a DBF or DBFOM procurement is often longer than a DB procurement in order to achieve the level of collaboration and innovation and lifecycle efficiency benefits that a DBFOM approach offers.

Typically, the public sector will conduct the procurement of a DBFOM project in two-stages. The first stage is a RFQ whereby the public sector receives and evaluates qualifications submitted by respondent teams. This evaluation results in a shortlist of proponents who are then invited to submit proposals to the second stage of the process, the RFP, in order to select the preferred private sector partner. A DB procurement tends to include a RFP bid only. Due to the high costs incurred by teams, as well as the resources from the public sector, to procure a DBFOM procurement, a two-stage process is desirable.

During the RFP stage, series of collaborative meetings between the public sector and the private sector partner are regular occurrences in each method of procurement, however the DBF or DBFOM focuses both on the technical and design issues as well as on lifecycle, commercial and financial aspects of the project. As the private sector partner is assuming greater risk transfer under the DBFOM model through not only the design and construction, but extending throughout the entire project term, significant understanding and detail is required to prepare full proposal bids.

6.3 Development Costs and Fees

In general, the transaction costs, development costs and fees necessary to achieve financial close are likely to be higher under a DBFOM procurement than under a conventional DB procurement. These transaction costs are often seen as a friction which increases the cost of a DBFOM relative to conventional DB delivery. In fact the relatively higher transaction costs of DBFOM procurement are both cause and symptom of the increased intensity with which DBFOM's minimize, mitigate and allocate risks from the outset of the project. The contractor ensures that the designer produces and accepts risk on the best most constructible design possible. The operator makes sure that the contractor builds to the quality required. The equity investor makes sure that the operator is able to achieve the required performance standards for the lowest possible cost. The lender makes sure that all of these parties have analysed the risks sufficiently and are backing the risks with sufficient performance securities so that the lender is unlikely to be exposed to a loss of its principal in the event anyone fails to perform. This competitive pressure within the team is sufficiently powerful that the public sector can

obtain very competitive outcomes even when there is only one bidding team for the project, although this outcome should not be relied upon.

Each team will typically comprise a number of independent companies each of whom are focused on winning the bid by driving any excess profit margin out of their team members' pricing and risk acceptance. It is this virtuous circle of competitive pressure within a bidding team for a DBFOM which drives many of the performance benefits. This pressure is more effective than could ever be achieved through separate competitions for each element of the project because the team members are typically working on an open book basis, are highly knowledgeable counterparties to one another and are particularly motivated to win by the very high transaction costs of bidding a PPP.

Transaction costs are often mitigated in PPP transactions through the payment by the procuring authority of a stipend to compliant losing bidders. Use of a stipend can actually reduce overall costs.

6.4 Financing and Issuance Costs

Financing costs are the costs associated with arranging financing for a transaction. Under a DBF/DBFOM this will include the costs of arranging debt and equity that the private sector partner would be responsible for, and can include items such as arrangement fees, commitment fees, and swap credit premiums. These costs have been incorporated into the Shadow Bid as cash flows.

6.5 CDOT's Performance Monitoring and Contract Management Costs

For a DB or DBF project, CDOT's costs are typically spread throughout the design and construction phases. In contrast, a DBFOM project will see a significant part of CDOT's costs spent before the project starts construction as CDOT will typically spend more during the procurement process, both in choosing the best proponent and in drafting a project agreement. Following financial close, however, until the end of the project agreement, budgeted CDOT costs for performance monitoring and contract management for a DBFOM project can be considerably lower as the owner is only required to manage a single contract (i.e. the project agreement), compared to the higher cost of ongoing contract administration for many different procurements and the associated, potentially significant, interfaces between them.

As such, performance monitoring costs by CDOT are significantly lower under DBFOM delivery than under DB. This is also because the equity and debt providers under a DBFOM are incentivized to closely monitor construction from a schedule and quality point of view.

Below is a summary typical owner's costs during construction and operations phases of a project.

Figure 8: Performance Monitoring and Contract Management during the Construction and Operations Phases

Phase	Cost Description
Construction Phase Costs	<p>Construction management costs are incurred by the party responsible for overseeing work done during the construction phase of a project. These costs are less intensive for the public sector following procurement as a DBF/DBFOM, as the private sector partner bears the costs associated with overseeing construction, contract administration and for the majority of the quality assurance work. Although there may continue to be some legal and advisory costs related to implementing the project agreement, the role of the owner is reduced and requires a smaller team to administer the contract and monitor the construction of the project on behalf of the public sector. This monitoring includes the cost of an independent certifier to verify completion of the project, and is done to ensure the requirements of the project agreement are met.</p> <p>Under a DB, the contractor is charged with quality control for the project, with the public sector providing quality assurance by checking construction progress, ensuring compliance with agreements and regulations, soliciting information from the contractor, etc. Under a DBFOM, the contractor is still responsible for quality control, but the quality control responsibility is transferred to the concessionaire. Frequently, the contractor and the concessionaire are part of the same entity or are familiar with each other through past interactions, leading to a smoother relationship. In addition, historically, the costs associated with quality assurance are typically higher under a DB relative to a DBFOM (~3% of</p>

Phase	Cost Description
Operations Phase Costs	construction costs versus 1-2%). Operations management costs are the ongoing administrative costs to public sector of managing the project agreement with the private sector partner during the operations phase. These costs are less significant under either procurement approach relative to the design and construction period; however, under traditional procurement, the public sector will incur more direct costs as it operates the infrastructure itself, or contracts the work with one or more companies. Under the DBFOM model, the public sector's role is again limited to monitoring the performance of the private sector partner operating the asset/facility, according to the project agreement.

7. Design Cost Estimates

From the perspective of CDOT, there is a material difference in design costs incurred under a DB and a DBFOM. Under a DB, CDOT must undertake additional design work prior to launching the procurement process (25-30% design). Under a DBFOM, the vast majority of the design work is completed by the concessionaire, with CDOT only responsible for ~10% of the design. CDOT has indicated that preliminary design to date is at ~15%.

Part of this discrepancy is derived from the parties that seek to participate in the procurement process. As discussed earlier, a DB process will predominantly attract national construction companies, which typically are smaller than and have fewer internal design resources than major international firms. As such, they will have greater reliance upon external design firms with regard to developing designs for the project, increasing the total design costs.

Additionally, there is empirical evidence that suggests that design costs constitute a larger percentage of the total design and construction budget under a DB relative to a DBFOM. Although the exact figure will vary by project, design costs typically are 7-9% of the total costs under a DB versus 4-5% for a DBFOM.

8. Construction Cost Estimates

8.1 Competitive Landscape

A key driver for the construction cost differential under a DB procurement and a DBFOM procurement is the competitive landscape among contractors, which will be more expansive and diverse under a DBFOM procurement. Under a DB, the competition will be quite similar to that which CDOT sees in their normal DB procurement processes: predominantly large domestic contractors. Under a DBFOM procurement, the Project will attract international competition that will bring additional competitive tension to the market, driving the fixed construction price that is ultimately offered.

As a generalization these new competitors are typically large European integrated construction and concession companies. They differ from their traditional North American counterparts in a number of ways. These differences include being valued on construction backlog instead of contract profitability, having substantially larger turnover and balance sheet, operating on thinner profit margins, completing more design work in-house on a more integrated basis, and bringing innovations in construction methodologies and frequently participating in PPPs as operators and maintainers and equity investors as well as design-builders.

There is a quite marked difference in the approach to project definition and costing between these new competitors and traditional players which is illustrative of the opportunities for capital cost savings in PPPs. Traditional North American design and construction companies will typically approach project estimation from a bottom-up perspective. They will design the project and build up a cost estimate based on the design. This is similar to the approach used in conventional public sector delivery although there will be a much greater number of iterations of design and cost under a DBFOM. This often means that the final price of the project is determined late in the bidding phase. The new competitors typically bring a target price attitude towards the project. They determine what they think the asset should cost, what the competitive price will be and what the public sector can afford and will then design the project to try to meet this target price. While it is unclear whether this significantly different approach to project development and pricing originated from the greater use of PPP delivery models in their home markets or because of other cultural or market factors, flexibility to innovate solutions in PPPs provides a very good platform for this approach. Approaching the market as if there is a single fixed cost of delivery of a particular asset of service, creates a division of the cost between the various participants in a transaction becomes a zero sum game. If the design-builder makes a higher profit, it is at the expense of higher payments by the public sector. The significant differences arising from a target price approach compared to bottom-up estimating demonstrate that there is often no single price for an asset which effectively delivers a set of defined performance outcomes.

These new entrants to the markets have been delivering integrated PPP's in a very competitive market for a long period of time. Through experience they have learned how to leverage all cost reduction opportunities in an integrated DBFOM. Traditional North American contractors have generally reacted effectively to this change in the competitive dynamic, both by partnering with new entrants to the market and competing with them.

It is estimated that the additional competitive tension provided under a DBFOM procurement could provide approximately 4-5% savings in total construction costs relative to a DB procurement.

8.1.1 Attractiveness / Attention

As public finances continue to be stressed, and experience with PPPs expands, the role PPPs play continues to grow. Most everyone agrees that PPPs represent a growing market in the US, and while it will not replace traditional project delivery it is an important one to gain experience in.

In order to qualify for opportunities, a government will typically require contractors to demonstrate necessary expertise and recent experience with a particular procurement method. This gives contractors – domestic and international – added incentive to aggressively pursue PPPs in order to gain necessary experience and credentials in the growing industry in the US.

Given the growth opportunities, it is imperative for domestic contractors to expand their credentials with PPPs in order to establish future business opportunities. Further, international contractors, who want to gain access to the US market, tend to almost exclusively pursue PPP projects. Because of the benefits of participation in a high profile PPP in a major US market, management for these contractors are likely to be more aggressive and take more risk on pricing from subcontractors.

This is especially the case in Colorado, which the market sees as an emerging market for future PPP projects. Contractors will have any more interest to gain experience in the market to better position themselves for future opportunities.

Macquarie estimates that this additional dynamic could provide approximately 1-2% savings in total construction costs relative to a DB procurement.

8.1.2 Innovation

Under the PSC, the schedule begins with the release of the RFP for the project, followed by the review of the proposals over a roughly three month period. Very little interaction takes place between the proposers and the public sector owner, and upon selection of a bidder, construction begins immediately.

In the DBFOM procurement, the public sector owner would review bids over a longer period, during which time they would interact with bidders on a one-on-one basis to optimize proposals and the results. Additionally, bidders are encouraged to put forth Alternative Technical Concepts (“ATC”) that would provide an opportunity for project innovation and cost savings, not found in a traditional DB procurement. For example, the Denver FasTracks Eagle PPP incorporated 17 ATC’s into the project’s scope that saved the Regional Transit District \$300 million and further reduced overall operations and maintenance expenses. Another complex highway PPP in Florida, I-595, also achieved savings of nearly \$300 million by using ATCs that utilized a different approach to the project and shifted additional risks to the private sector.

Following the selection of a preferred bidder, there would be an additional period of time, during which the selected contractor can continue to work with the public sector owner in order to improve the efficiency of the project. By the time construction commences, the project has been optimized to maximize the value of the project, while minimizing costs.

Macquarie estimates that innovation under a DBFOM could lead to approximately 4-8% savings in total construction costs relative to a DB procurement without scope for innovative solutions from bidders.

8.1.3 Financing Impacts & Mobilization

The construction payment curve under a PSC and a Shadow Bid differ as a result of the source of the funding. Under a PSC, the government entity is responsible for the mobilization payment to the contractor. The government entity will structure the lowest possible upfront payment, which the contractor will accept, assuming it is paired with an appropriate price adjustment. Additionally, that mobilization payment, as well as any milestone payments made during the construction period is completely at risk to the government entity.

In the Shadow Bid, the private sector partner is responsible for the mobilization payment, and the government entity would not be responsible for any payments until the construction period is successfully completed (excluding any public contributions or milestone payments). The private sector partner would be inclined to make a larger mobilization payment, which will result in a reduced construction cost. This would afford the contractor the ability to hedge against construction materials, which might be very volatile over a lengthy construction period.

8.1.4 Equity Contribution

In a DBFOM, most contractors will make an equity contribution into the project. The equity contribution is another profit center for the contractor, incentivizing them to be more aggressive on the construction price and take more risk. They are willing to do this since they make a profit on their equity contribution, thus they can afford a smaller return on the construction price.

Under a DB, the contractor will typically target a profit margin of 10-12%. Whereas in a DBFOM, the target profit margin is in the 7-10% range. Most contractors have realized that under a DBFOM procurement, the probability

of obtaining the profit that is used at bid time is higher than the one that is bid under a DB therefore reflecting that higher probability into a lower profit at bid time. This benefit will be ultimately transferred to the DOT under a DBFOM but not under a DB.

Relative to a DB procurement, Macquarie estimates the element of the equity contribution by the concessionaire under a PPP could provide up to 2% savings in total construction costs.

8.1.5 Pavement Thickness

The type of procurement method chosen by CDOT will have an impact on some of the technical specifications of the Project, most notably, the initial thickness of the pavement placed during the construction period. Under a DB, the contractor will be required to provide a specific thickness prescribed by CDOT. This thickness is not based on current or near term levels of traffic for the road, but levels further into the future once construction is complete. The contractor, under a DB, will not be responsible for major rehabilitation and maintenance capital expenditures, such as increasing the thickness of the pavement, after the construction period. With this knowledge and not wanting to undertake significant capital expenditures on a recently constructed asset itself, CDOT will demand a level of thickness that will support forecast levels of traffic reached several years after construction.

In contrast, under a DBFOM, the private sector partner will be responsible for not only the initial construction of the road but long-term lifecycle costs and capital expenditures as well. As such, CDOT may leave this (and other) design elements to the responsibility of the private sector partner in order to fit their long-term strategy. This results in a more optimized use of the initial capital expenditure and reduces the initial cost to CDOT. This feature of a DBFOM will lead to a lower total construction cost as the private sector partner is able to optimize pavement thickness by considering total lifecycle costs rather than having this technical requirement dictated by CDOT.

Relative to a DB procurement, Macquarie estimates that this element could provide less than 1% savings in total construction costs under a PPP.

8.1.6 Performance Security

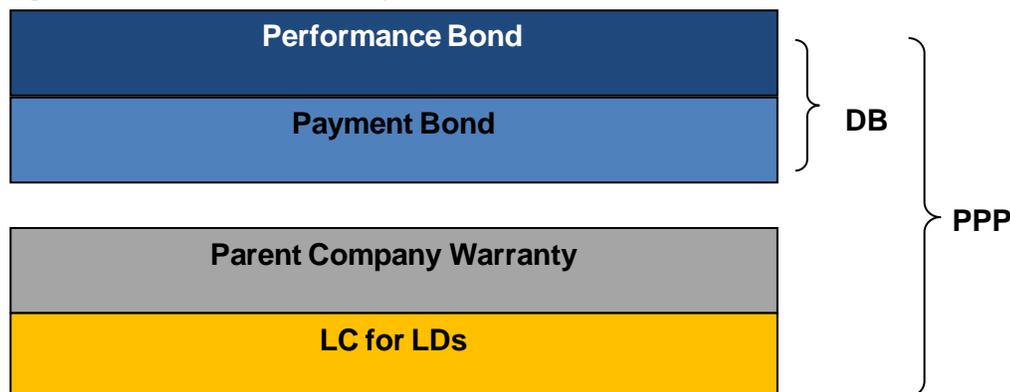
A DBF or DBFOM will typically require different and significantly greater construction completion and performance securities than a DB. The typical security package for DB projects procured in Colorado is made up of:

- Performance Bond: equal to ~25% of construction cost; and
- Payment Bond: equal to ~5-10% of construction cost.

For a DBFOM, the requirements are more stringent. In addition to the performance and payment bonds, which are mandated features of DB contracts, the concessionaire will be obligated to produce:

- Parent company warranty: equal to 40% of construction cost; and
- Letter of Credit (“LC”) for Liquidated Damages (“LD”): equal to 10% of construction cost.

Figure 9: Performance Security



Due to the additional performance security under a DBF/DBFOM, the private sector partner is better incentivized to meet its obligations under the project, specifically meeting the agreed construction schedule.

8.2 Evidence of Construction Cost Savings under DBFOM

There have been large differences between winning and losing bidders and high correlation between losing PPP bidder and PSC which supports this VfM analysis as shown below.

Figure 10: Construction Cost Savings Achieved in North American PPP Market

Project	Savings Relative to PSC	Savings Relative to Competitor	Comments
I-595, Florida (Road)	14.3% lower than PSC (\$300m)	30% below next most competitive price	ATC's and risk transfer
A30, Quebec (Road + Bridge)	33% lower than PSC	~20% below competitor	Hybrid toll and availability
Denver FasTracks, Colorado (Transit)	13% lower than PSC	~20% below competitor (\$300m)	17 ATC's accepted
Southeast Stoney Trail, Alberta (Road)	NPV 63% below PSC	~40% below competitor	Innovation and market shift
Alberta Road Projects (Average of 5 Projects)	NPV 27% below PSC	-	2003 - 2012
Windsor Essex Parkway, Ontario (Road)	NPV 15% below PSC	~20% below competitor	
I-635 (LBJ Freeway), Texas (Road)	NPV 15% below PSC	~50% below competitor	
Port of Miami Tunnel, Florida (Road / Tunnel)	12.5% lower capital costs than PSC	~50% below competitor	Based on VfM analysis 2010
Goethels Bridge, New York (Road / Bridge)	13.7% lower than PSC	~7.2% below high bid	
Presidio Parkway, California (Road)	20% lower than PSC	-	Separate DBFOM and DB projects

9. Construction Risk and Contingencies

9.1 Specific Performance Contingency

Because a DB will not guarantee a lump sum date certain price in the same way as a DBFOM, the DB model will need to carry a specific cost contingency in addition to shared and retained risks.

These findings are also consistent with other studies. For example, a study undertaken by Infrastructure Partnerships Australia found that “PPPs provide superior performance in both the cost and time dimensions, and that the PPP advantage increases (in absolute terms) with the size and complexity of projects. While smaller traditionally procured projects were completed ahead of time, they found that project size had a marked (statistically significant) negative impact on time over-runs compared with PPPs, whose timeliness of completion were not negatively impacted by size of project.”³

TIFIA may also require a contingency when lending to CBE on a subordinated basis.

³ <http://www.infrastructure.org.au/content/PPP.aspx>; Performance of PPPs and Traditional Procurement in Australia

10. Construction Schedule

One of the key benefits of DBFOM delivery is to achieve schedule and cost certainty; additionally, a DBFOM can be beneficial in accelerating the construction timetable.

The costs and risks associated with a delay in implementing the Project need to be specifically assessed. These include:

- Additional mobilization and other construction costs as a result of delay;
- The foregone benefits that would have been enjoyed by users; and
- The additional costs of interest during construction as a result of late delivery.

Note that these costs are commonly not taken into account in a public sector procurement.

Schedule certainty has a value which is not always properly taken into account under conventional public sector procurement. This is important as the more accelerated the schedule is, and the greater the schedule certainty required, the likely greater the premium for taking schedule risk is.

DBFOM structures differ in their approach to schedule:

- Some can best be described as schedule neutral and leave the private sector to optimize the schedule based upon balancing the risks of accelerated construction against the costs of additional interest during construction. In general this is the preferred approach, especially for availability payment transactions;
- Some provide significant incentives for early completion by allowing the private sector partner to achieve significantly higher revenues or bonuses for early completion. This is common in user pay scenarios; and
- Some mandate a particular completion date (for example because an asset needs to be completed for a major event like the Olympics, or because of political commitments to completion). While the ability to meet an accelerated completion date with certainty can be an important advantage of PPP delivery, care must be taken to properly cost the additional risks from an accelerated completion schedule.

There is significant empirical evidence that DBFOM delivery will achieve a faster completion schedule than a DB or DBF. In 2003, UK's National Audit Office ("**NAO**") completed a review of the country's Private Finance Initiative, the equivalent of a PPP program in the US. The NAO concluded that the PPP procurement format significantly increases likelihood of on-time delivery of projects. The report observed that 24 percent of the PPP projects were delivered later than the date specified in the contract and 70 percent of the central government's projects were delivered late.⁴

A benefit often claimed for DBFOM delivery is that projects are completed faster than conventional government procurement. The winning DBFOM bid will almost invariably be the one which completes the project the most quickly. This may seem counterintuitive. Relative to conventional contracting mechanisms the penalties for a contractor in respect of any delays or failures to complete on time are severe. This should make a DBFOM contractor more cautious about aggressive schedule than their conventional counterpart. Also conventional wisdom suggests that there would be a cost premium for accelerated delivery. There are a number of elements to this.

Conventional procurement often drip feeds capital into projects resulting in a sub-optimal construction timeframe. As discussed further below a large proportion of construction costs which are contestable are linked to mobilization and supervision costs which are invariably larger the longer the construction schedule is. Set against this is the risk of acceleration beyond the optimal schedule. In many cases DBFOMs will incentivize the private sector partner to accept the risks of acceleration by offering earlier and larger revenues for early completion (in effect an early completion bonus). However, this early completion bonus has typically been non-existent or very small in most Canadian availability style PPPs over recent years and yet we have seen the trend towards accelerated schedules continuing. In Macquarie's experience, this is driven largely by the role of private sector financing, and in particular, compounding interest during construction ("**IDC**")⁵.

⁴ *PFI: Construction Performance*, UK National Audit Office, Report by the Comptroller and Auditor General, HC 371 Session 2002-2003, February 5, 2003, p. 2

⁵ See Conference Board of Canada, 2010 p. 9

Based on the experience described above, Macquarie estimates that a DBFOM will deliver the project six months earlier than a DB:

- DB will not guarantee a lump sum date certain price in the same way as a DBFOM;
- DB will need to carry a specific cost contingency in addition to shared and retained risks; and
- CDOT should develop a value for schedule achievement including early completion.

There is significant empirical evidence to suggest that DBFOM delivery results in faster construction completion at a lower overall cost than conventional delivery. There are many reasons for this. However, the main drivers are:

- The desire by the private sector partner under a DBFOM to reduce IDC in order to improve competitiveness; and
- The desire by the private sector partner to complete the project and earn revenues as early as possible to reduce its overall WACC.

In a DB project, which is without these drivers, few mechanisms exist to optimize construction schedule.

VfM assessment requires a way to value and quantify the benefit of earlier completion.

11. Operations & Maintenance, Rehabilitation Cost Estimates

Concessionaire Management Costs

Under a DBFOM, many of the management functions usually undertaken by CDOT are delegated to the concessionaire, who will typically establish and staff a special purpose vehicle (“SPV”) to manage the project. Certain SPV costs, notably insurance, may be covered internally by CDOT (for example through self insurance) and therefore represent a retained risk under DB and DBF models.

Transfer of Operations, Maintenance and Rehabilitation (OMR) Risks

In a DBFOM, the private sector partner brings together an integrated consortium which is responsible for the long-term performance of the system. The long-term contract performance payment mechanism is the key to providing a stronger, more effective means of optimizing the Project’s lifecycle costs in a way that meets program and performance requirements. CDOT can structure the performance specifications to encourage the private sector partner to develop and operate a system that is well-operated and maintained. CDOT seeks a highway which functions smoothly and offers reliable transportation service.

Proponents of DBF and DBOM models will often argue that the public sector can protect its long-term interests without going to the additional complexity or expense of entering into long-term private financing concessions by an extensive commissioning period for the asset. This approach is effective to some degree for a limited number of types of infrastructure asset and may indeed offer benefits relative to conventional procurement and delivery methods. However, the performance and lifecycle costs of the vast majority of infrastructure asset classes are heavily dependent upon how they are operated and maintained and not simply on how well they are built. Passing an extended commissioning period is not necessarily a good guide to how well the asset will perform over the longer term. As a matter of practice, although this again is something conventional procurement could do better, we almost invariably see significantly longer and more extensive commissioning and warranty periods within the DB component of a PPP than we do in conventional procurements. The United Kingdom National Audit Office study of highway PPPs found savings of 34% on operating costs relative to 19% on capital costs. This led to overall lifecycle savings of 17%. Direct comparisons between PPP operating and maintenance costs and those of conventional public sector procurements are challenging in large part because governments often do not have a clear or consistent record of their true operating and maintenance costs since these costs are often managed on a reactive or crisis basis and frequently come from multiple different budget sources. Accordingly, even when good data is available from the public sector it would not provide a representative sample since data is more likely to be available from situations in which there has been a crisis of some sort.

DBFM

As a variant of the full DBFOM model, DBFM is possible where CDOT retains responsibility for routine O&M as part of its overall network. The concessionaire is responsible for major maintenance and rehabilitation.

Under this model, clear risk transfer is difficult to achieve due to the separation of routine and major lifecycle elements. It can be difficult to distinguish which aspects fall into routine maintenance and which aspects are considered a part of major rehabilitation. Furthermore as the major maintenance and rehabilitation profile is partially or indirectly a derivation of the level of regular O&M performed on the asset, this can create a misalignment of interest between the government and the private sector entity. As a result, interface risk becomes a material concern for the financing providers which could result in decreased competitiveness of this procurement option. Also, any potential optimization of tolling revenues as a result of the concessionaire performing all aspects of the operations and maintenance of the asset is lost in this procurement variant of the DBFOM model.

This should only be considered if the costs of self performance of O&M by CDOT are materially lower than under a PPP or if there are significant political or union obstacles to the transfer of O&M functions. For the reasons

described below Macquarie anticipates that OMR functions under a full DBFOM model will be cost competitive with CDOT self performance.

OMR Cost Estimates

Operations and maintenance cost estimates were developed using Macquarie’s proprietary cost model comprised of four components: toll equipment costs, operating costs, rehabilitation costs, and administrative costs. We use a “bottoms-up” approach to calculate individual unit costs, staffing costs and market prices for materials. The PSC assumptions for quantities of materials were held constant, with the variability being driven by the unit costs. Rehabilitation costs were estimated using the unit costs and segment data from the Shadow Bid. CDOT’s recent experience with the US 36 public private partnership validates our preliminary estimate that private sector could deliver OMR costs at 10-15% below the public sector. This is also broadly consistent with experience in other projects in the U.S. transportation PPP market, in which the private sector is incentivized to make design/construction and maintenance choices that minimize the lifecycle costs of the project, potentially producing material savings over time.

We anticipate the competitive process and the ability to identify local subcontractors to perform work on a marginal cost rather than a fully loaded basis will substantially reduce these preliminary cost estimates.

Experience with Transfer of OMR Risk

There is considerable market evidence that DBFOM procurement results in more cost effective as well as higher quality operations, maintenance and rehabilitation performance and that significant OMR savings can be achieved by the private sector.

Title	Author	Savings between PSC and Shadow Bid
“Port of Miami Tunnel Value for Money Analysis” (2010)	Florida Department of Transportation	22.5%
“I-595 Corridor Improvements Value for Money Analysis” (2009)	Florida Department of Transportation	25%
“Performance Based Contracting: The US versus the World” (2009)	Florida Department of Transportation	15.7%
“Outsourcing Versus In-House Highway Maintenance: Cost Comparison and Decision Factors” (2006)	Virginia Department of Transportation	12%
“Competitive Contracting for Highway Maintenance: Lessons Learned from the National Experience” (2004)	Massachusetts Department of Transportation by E. Montague and G.F. Segal	21%

Affordability Payment

There is precedent from the Denver FasTracks Eagle P3 procurement for the annual Availability Payment associated with OMR to be subject to appropriation by CDOT. For the Denver Eagle P3 Project, the Availability Payment was split into two parts: one payment covering debt service which was not subject to appropriations and one payment covering O&M which could be reduced if the concessionaire failed to meet performance targets (subject to annual appropriations by the RTD board). Originally, bidders warned that the deal would not be financeable because the Availability Payment would be subject to appropriation; however, the agency responded by promising not to use its remaining authority to borrow money for other FasTracks projects. In the event that either party defaulted, a trustee would disburse sales tax revenues first for existing debt payments and then for Eagle P3 service payments.⁶

⁶ Source: http://www.pwfinance.net/document/research_reprints/7%20denver%20eagle.pdf.

12. Managed Lane Tolling Revenues

Transfer of Tolling Revenues

Successful capture of the tolling revenue streams will depend upon the design and construction of the overall Project and the effective operation, maintenance, and rehabilitation of the whole Project.

Macquarie believes that the risk of future tolling revenues can be transferred to the private sector partner and will significantly reduce the need for availability payments from CDOT for OMR costs. In taking tolling revenue risk, the private sector partner will be strongly motivated to operate, maintain, and rehabilitate the Project to the highest standards. We believe such volume-risk structure provides significant benefits, however its success is subject to risk appetite by market participants.

Approach to Forecasting Tolling Revenues

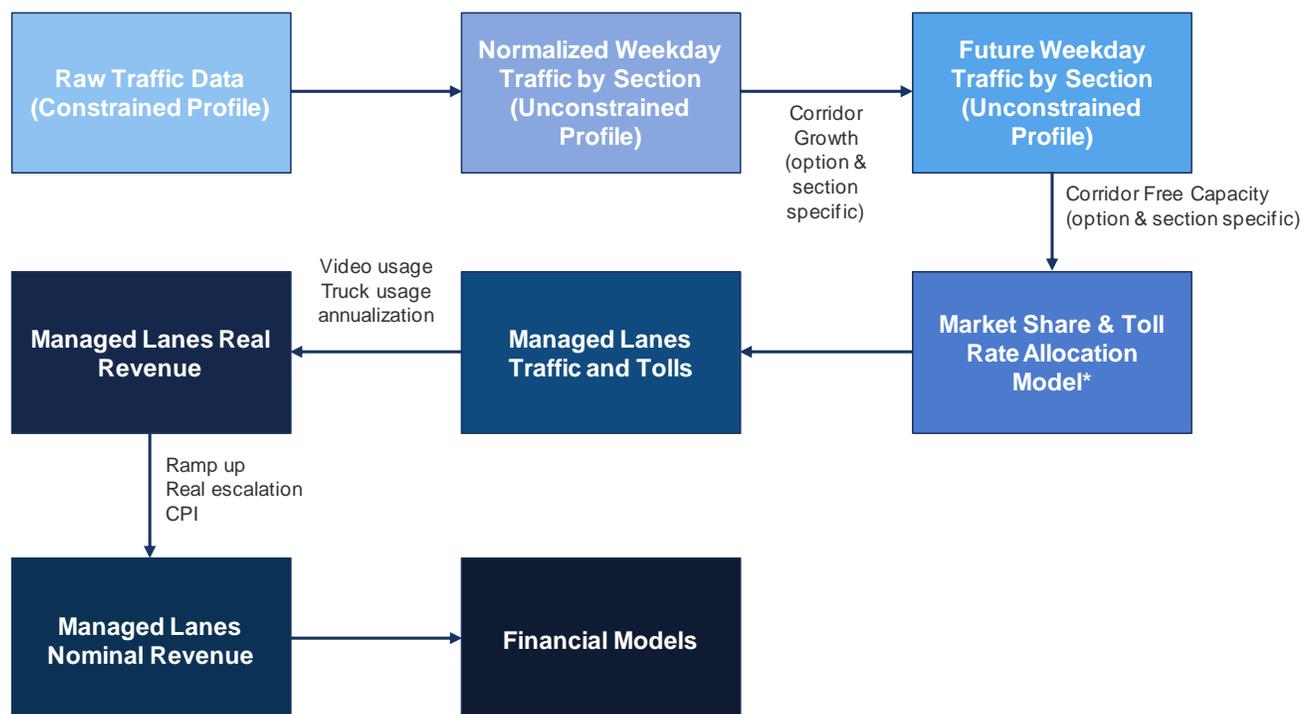
In order to construct the traffic and toll revenue forecasts, the modelling analysis focused on:

- Determining the potential number of vehicles that use I-70 today and in the future (potential demand).
- Determining the percentage of I-70 users that are expected to use the managed lanes (market share) at a given toll level (pricing power) considering a given level of traffic congestion (capacity congestion).
- Determining the relationship between potential demand, capacity, congestion and market share/pricing power based on actual toll managed lanes usage (revealed preference) from operating roadways both locally (I25 express lanes) and historically (SR 91 express lanes).
- Comprehensive corridor traffic data that Macquarie was able to assemble with assistance from CDOT and its EIS consultant.
- Traffic data from CDOT/OTIS, including:
 - Existing I-25 managed lanes and GP lane traffic and speed data;
 - Existing I-70E general purpose lane volume and speed data; and
 - Existing I-270 general purpose lane volume and speed data.
- Supplemental EIS:
 - Additional volume counts and vehicle mix along I-70; and
 - Forecast growth in corridor (from DRCOG model).
- Public data available for SR-91 corridor traffic, managed lanes and tolls.

Given the inherent volatility and sensitivity in a managed lanes forecast, Macquarie produced a range of revenue forecast outcomes that would represent the views of the “cautious” bidders to those of the “aggressive” bidders. For scenario analysis purposes, Macquarie created a “median” forecast for the DBFOM scenario, representing the mid-point between a given case’s “cautious” and “aggressive” view, which is meant to represent a realistic best bidder outcome.

The various steps and sequencing of the forecasting process are illustrated in Figure 11 below.

Figure 11: I-70 Managed Lanes Forecasting Model Structure



*Note: simplified for viaduct full tolling option

Description of the analysis and modeling steps illustrated above:

- **Raw Traffic Data:** Hourly traffic profiles obtained from surveys and permanent count stations were analyzed and it was found that a number of locations exhibited typical profiles of capacity constraint throughput (i.e. wide peak periods and small differences between peak and inter-peak volumes).
- **Normalized Traffic:** The Project will increase available capacity and as a result it is anticipated that hourly profiles will return to a more typical unconstrained profile, with clearly defined peak periods.
- **Future Corridor Traffic:** Sectional traffic was factored up to account for future growth and was based on the EIS forecast corridor growth. Some adjustment was applied for induced demand (at opening) and maturing growth in the longer term as the corridor re-congests itself.
- **Market Share and Toll Rates:** Capture rates and pricing power were analyzed on operating managed lane facilities – namely the I-25 express lanes in Denver and the SR-91 express lanes in Orange County, CA. It was found that a strong correlation exists between managed lane capture rates, tolls charged and corridor demand relative to free capacity. **Error! Reference source not found.** depicts the revealed relationship between managed lanes revenue generation (which is the product of capture rates, corridor demand and tolls charged) and corridor demand itself.
- **Forecast Managed Lanes Traffic and Tolls** are obtained by application the empirically based market share and (real) toll rate allocation models to forecast corridor traffic. The models are applied on an hourly and directional basis for a typical weekday and for each of the defined toll segments. The forecasts are then annualized, based on revealed experience from operating managed lanes.
- **Forecast Real Revenue** is the product of potential demand, market share and real tolls obtained from the previous step. In addition, a view is taken in terms of vehicle mix (e.g. light vehicles vs. trucks) and transponder penetration (vs. video tolling) that have an implication on average toll paid per transaction.
- **Forecast Nominal Revenue:** Real revenues are converted to nominal revenues, using forecast CPI and an affordability index (real increases in pricing power in relation to increases in real personal incomes over time). Some allowance for ramp up is made in early years.

Costs of Tolling Operations

In order to capture and process the tolls on the managed lanes, there are fixed and variable costs incurred by the concessionaire. These costs vary between users who belong to the toll collection system and have installed vehicle-mounted transponders and users who are not registered with the toll collection system and are billed through video license-plate recognition technology.

The assumptions for these costs were generated using costs realized on a variety of existing Macquarie assets and forecasts for several projects in development.

13. Risk Transfer

The table below compares the risk transfer in both a DB and PPP (DBFOM) model. Specific discussion on risks retained and shared by CDOT is provided following the table.

13.1 Risk Transfer Overview

Risk	DB Risk Allocation		PPP Risk Allocation		Commentary
	Private Sector	CDOT	Private Sector	CDOT	
Construction Cost & Schedule	X		X		<p>DBFOM delivery tends to result in faster construction completion at a lower overall cost than conventional delivery. There are many reasons for this. However, the main drivers are:</p> <ul style="list-style-type: none"> • The desire by the private sector partner under a DBFOM to reduce IDC in order to improve competitiveness; • The desire by the private sector partner to complete the project and earn revenues as early as possible to reduce its overall WACC; • DB will not guarantee a lump sum date certain price in the same way as a DBFOM; and • DB will need to carry a specific cost contingency in addition to shared and retained risks. <p>In a DB project, which is without these drivers, few mechanisms exist to optimize construction schedule.</p>
Design Errors and Omissions		X	X		<p>CDOT retains the risk of design errors and omissions under the DB and transfers this risk in the DBFOM option. The Project design is inevitably a complex task given the Project's varied scope elements and the complicating factor of the rail system.</p> <p>In a DB, CDOT bears responsibility for ensuring that the design meets the Project requirements, both during the construction and throughout the operations period. CDOT does not have the benefit of working with the builder to discuss the design and address any potential issues before the construction actually begins. There is a strong likelihood that certain design elements will be incomplete or contain errors which would result in additional re-design work, potential reconstruction of certain work and likely delay the Project.</p> <p>In a DBFOM, the private sector partner's integrated design and construction team is responsible for ensuring the design meets the performance specifications outlined in the project agreement. The private sector partner is motivated to mitigate the consequences associated with any errors or omissions due to the performance levers in the contract. They are also unlikely to price in the value of the risk into their bid given they control the design process.</p>

Risk	DB Risk Allocation		PPP Risk Allocation		Commentary
	Private Sector	CDOT	Private Sector	CDOT	
Known Pre-existing Site Conditions		X	X		Under DB known pre-existing conditions are still the responsibility of CDOT. Under a DBFOM, CDOT can transfer some or all of the known pre-existing conditions of the Project site.
Long-Term Asset Performance		X	X		<p>CDOT retains long-term asset performance risk under the DB and fully transfers this risk in the DBFOM option. Over time, this risk can result in a highway that costs significantly more than estimated to operate and maintain and can ultimately lead to a failure in meeting expected long-term performance objectives (i.e. quality of asset, ease of transportation for citizens).</p> <p>In a DB, CDOT designs the Project, transfers the construction process to third parties and holds the long-term asset performance risk upon commencement of operations. Operational impacts are only taken into consideration to the extent that CDOT and the technical team involve people with operational expertise early into the Project. During the initial warranty period (which typically lasts the first three to five years of operations), CDOT can hold the contractors and the system manufacturers accountable for any specific problems encountered with their elements. Following the warranty period, CDOT is solely responsible for the system performance. While CDOT may be able to hire a qualified operator, it will be difficult and costly to transfer any sort of significant operational risks to a party not involved in the Project's design and development from the start.</p>
Major Lifecycle and Maintenance		X	X		<p>CDOT retains deferred maintenance and rehabilitation risk under a DB but transfers this risk in the DBFOM option. Government assets in the United States are potentially subject to deferred maintenance issues due to budgetary constraints. Government budgets tend to have many high priority items to which they must allocate funding. In a DB, CDOT is not contractually obligated to pay for the Project's necessary lifecycle and rehabilitation costs and can defer the expenditures as it sees fit. A lack of regularly scheduled maintenance and rehabilitation will lead to a deteriorating and poor performing asset in the long run.</p> <p>In a DBFOM, the private sector partner is responsible for meeting the lifecycle service performance standards laid out in the project agreement with significant financial penalties for non-performance. The private sector partner must pay to upkeep the Project according to the standards, thus preventing deferred maintenance and rehabilitation.</p>
Force Majeure / Relief Events		X	X	X	<p>In a DB, a Force Majeure event during the construction period would have implications stipulated between CDOT and the contractor, which would be stipulated in the DB agreement. During the operating period, CDOT would be responsible for the costs and lost revenues associated with the event.</p> <p>Under a DBFOM, the project agreement will outline provisions for force majeure and relief events between CDOT, the concessionaire and the contractor.</p>

Risk	DB Risk Allocation		PPP Risk Allocation		Commentary
	Private Sector	CDOT	Private Sector	CDOT	
Scope Changes		X		X	<p>CDOT retains the risk of scope changes under both the DB and DBFOM options, but the potential cost impacts of the risk often vary significantly between the options.</p> <p>Under a DB, CDOT bears design responsibility, whereas under a DBFOM, CDOT transfers design responsibility to the private sector partner. Under both options, CDOT may attempt to pursue a 'no net change' policy, meaning that any additional scope requests must be offset by a corresponding decrease elsewhere. However, under a DB, CDOT bears responsible for the design schedule and there is a greater possibility that scope changes will be considered and accepted. Finally, during construction, the contractor does not have the incentive to work with CDOT to see how changes could be implemented at a lower cost.</p> <p>Under a DBFOM, the private sector partner is incentivized to push the design forward to meet the schedule requirement which imposes a level of discipline on the design process that is non-existent on the DB.</p>
Regulation Changes		X		X	<p>Under a DB, the effects of regulation changes would be borne by CDOT. Under a PPP, regulation changes would typically trigger a compensation event, in which the private sector partner would be made whole by the government entity. Based on the agreement, this repayment to the private sector partner may include just a repayment of costs expended or may additionally compensate the concessionaire with an equity return</p>
Rail Relocation		X		X	<p>A primary consideration for CDOT and a source of risk for the Project under any procurement method is the necessary relocation of the Union Pacific Railroad that is under the viaduct. The contractor or concessionaire is likely to view and price this risk in a similar manner under a DB or DBFOM, respectively. They will require explicit instruction from CDOT with regard to the scope of the specific work associated with the railroad and the risk transfer that takes place under either scenario will be effectively the same.</p> <p>It has been suggested that CDOT might consider altering the scope of the Project, extracting out that element related to the rail relocation and running two separate DB procurement processes. This approach is not advisable for two main reasons.</p> <p>Firstly, splitting the Project into two separate projects is likely to create interface issues between the two parties completing the work. The two contractors would be working in close quarters and it would require an extraordinary degree of planning, monitoring, and coordination to ensure that conflicts would not arise and the teams could work efficiently.</p> <p>Secondly, while the railroad relocation is certainly a key issue for the Project, it can be accommodated at the same time that the viaduct is being built. Even if there is some delay associated with the railroad relocation, the contractor would be able to reschedule around those delays by accelerating other parts of the Project and potentially still be able to complete the Project on time.</p>

13.2 Retained Risks

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

CDOT will retain certain development and construction risks under the DB, DBF and DBFOM procurement methods. Retained risks are quantified, where possible, with the resulting expected value being equivalent to the government's expected cost of self-insuring them.

The major retained risks which have been identified at this stage include:

- Environmental;
- Land Acquisition;
- Changes in Law;
- Seismic Events;
- Force Majeure;
- Unknown Contaminated Material; and
- Unknown Pre-Existing Site Conditions.

The costs related to these risks would be essentially the same under the various forms of procurement; however, there may be some scope for savings under a DBFOM. For example, with respect to Land Acquisition, an innovative design developed under a DBFOM might utilize less acreage than a DB design which could lead to marginal savings.

13.3 Shared Risks

Risks that are shared between the private sector and government represent a cost to the project regardless of procurement model. CDOT will share certain risks under both a DB and DBFOM; however, a DBFOM will significantly mitigate the likelihood of occurrence. This is because the concessionaire will be responsible for the first loss as a result of the occurrence of a shared risk. This provides a strong incentive for the concessionaire to innovate design and construction solutions which mitigate or eliminate the risk. CDOT only starts to share in the risk as the magnitude of the losses become significant. In most cases, CDOT should be able to satisfy itself that this is a remote risk and accordingly carry limited or no contingency against the risk.

The major shared risks which have been identified at this stage in the Project analysis are presented below.

Figure 12: Shared Risks

Shared Risk	Description	Quantification
Geotechnical Conditions	Geotechnical risks that are beyond those conditions anticipated in baseline.	The concessionaire will bear the risk of all conditions including: changes in surface topography; variations in subsurface moisture content, any archaeological, paleontological or cultural resources; occurring on, under or about the Project Right of Way on which the work is performed; geotechnical condition risk on the existing asset will remain the risk of CDOT.
Hazardous Material Removal Risk	Unknown conditions not identified or discovered prior to the contract finalization; can be shared through a deductible.	The concessionaire will bear the risk of all conditions including: Hazardous Substances, including contaminated groundwater; occurring on, under or about the Project Right of Way on which the work is performed; geotechnical condition risk on the existing asset will remain the risk of CDOT.
Utilities - Unexpected relocation and risks	Beyond certain timeframes or costs; this can be transferred through a deductible mechanism.	This can be transferred through a deductible mechanism. The concessionaire will take care of the first \$5m, the next \$5m will be shared 50/50 with CDOT and anything above \$10m will be 100% the

Shared Risk	Description	Quantification
Existing Asset Conditions	Existing asset conditions are treated differently based on when the discovery was made; upon construction commencement, much of the existing asset condition risk is transferred to the concessionaire or DB contractor.	risk of CDOT. The values can be adjusted. The concessionaire is entitled to a site investigation, after which, it should be satisfied as to the condition of the site. From this point forward, the concessionaire would be responsible for costs related to existing site conditions.
Public Outreach	Can be transferred to the concessionaire but not to the construction party. Estimated at \$200K per year.	Under a DBFOM, the concessionaire is additionally committed to the success of the project and would therefore dedicate resources toward public outreach, that would not be present under a DB.
Inflation Risk	Will affect both the project costs and the project revenue, which would be captured by CDOT.	Under a DBFOM, the concessionaire would take the risk related to materials cost during construction and operations.
Structural Latent Defects	Delay due to latent defects during construction.	The concessionaire or contractor's liability includes design defects and latent construction defects. However, CDOT shall have responsibility for latent construction defects in the GP Lanes.
O&M During Construction	CDOT cannot transfer this under a DB since the contractors will not agree. Under a DBFOM, it is a standard clause to transfer the O&M during construction to the concessionaire.	Under a DB, this risk would be retained by CDOT as there would no third party involvement in the project following construction completion. Under a DBFOM, the concessionaire would maintain and operate the road throughout the life of the concession and would therefore retain that risk.

14. Conclusion

There are a number of qualitative benefits to a DBFOM delivery model including:

- Earlier completion;
- Transfer of specific project risk elements not fully captured in the contingency;
- Greater certainty and transparency of performance; and
- Additional taxes paid and economic activity generated by the private sector partner.

DBFOM procurement will also require a greater commitment from CDOT in respect of operations, maintenance and rehabilitation costs which will reduce CDOT's flexibility to defer maintenance costs in years of tight budgets. Additionally, DBFOM procurement significantly mitigates risks to affordability and to CBE's credit rating relative to both DB and DBF procurement. Finally, as shown below in Figure 13, significant economic activity would be generated by the Project as estimated in an economic impact analysis study prepared by John Dunham & Associates (New York), and BBC Research & Consulting (Denver).

Based on these benefits and the VfM analysis completed by Macquarie, Macquarie recommends that CDOT proceed with DBFOM procurement.

Figure 13: Economic Activity Benefits

	Direct			Total (including Supplier and Induced)			
	Jobs	Wages	Economic Impact	Jobs	Wages	Economic Impact	Sales Taxes
Construction Impact							
Regional	5,329	\$326m	\$671m	7,246	\$419m	\$946m	\$11.7m
Total	5,329	\$326m	\$671m	9,195	\$513m	\$1,197m	\$15.4m
Mobility Benefits							
Regional	45	\$2m	\$5.4m	71	\$3.7m	\$10.1m	\$128,409
Total	88	\$3.6m	\$11.4m	148	\$6.4m	\$19.7m	\$273,048
Business Productivity Benefits							
Regional	N/A	N/A	N/A	2,863	\$129m	\$445m	\$4.5m
Total	N/A	N/A	N/A	3,401	\$182m	\$529m	\$9.3m
Total Annual Recurring Benefits							
Regional	45	\$2m	\$5.4m	2,934	\$133m	\$456m	\$4.6m
Total	88	\$3.6m	\$11.4m	3,549	\$188m	\$549.	\$9.6m

A.1 Appendix: VfM Analysis Development Methodology

This appendix sets out a preferred approach to developing a VfM analysis to ensure a process which is both consistent with CDOT standards and also meets the requirements of the specific projects.

VfM Analysis Overview

Definition

The VfM analysis is a model of risk adjusted hypothetical costs associated with a traditional, government-financed delivery of a project. The Shadow Bid is CDOT's best estimate of how private sector proponents will respond to the tender process.

Purpose

The purpose of the VfM is to provide a comparison of the projected costs of project delivery between the proposed PPP, and conventional government delivery.

By making this comparison, the public sector can ensure that it obtains the best value for money for the project. This means it will only choose a PPP delivery method if the capital and/or operating costs of the private sector in delivering the same level of service are lower than those of public sector delivery on a risk adjusted basis (the PSC model).

The VfM analysis will also be a useful tool in ensuring that:

- The value of risk transfer to the private sector is appropriately measured and the private sector does not mis-price this risk;
- The private sector is incentivized to achieve an efficient financing structure, recognizing that the total cost of private sector capital will be higher than the public sector cost of borrowing;
- Any upside profit margins obtainable by the private sector are not disproportionate to the downside risks to which they are exposed; and
- If the private sector offers a higher level of service, any additional costs are relative to the benefits received.

The VfM analysis can potentially be used to assist the development of evaluation criteria to differentiate between PPP bids, and also to monitor the performance of the successful concessionaire.

Approach

The PSC is used as a benchmark, against which a Shadow Bid is assessed.

If the Shadow Bid is reasonably superior (assessed on both quantitative and qualitative criteria) to the PSC, then the project should proceed into PPP delivery. If the Shadow Bids are not superior, then either the PPP delivery method will need to be refined to correct any weaknesses or the project should not be delivered as a PPP.

The actual bids received from the market place in the tender process should then be compared to the Shadow Bid.

Features of PSC

Features of a PSC will typically include:

- Assumptions on the financial structure;
- Capital and operating costs;
- Revenues or payment streams;

- Risk adjustments of the cash flows; and
- Cash flows discounted using a rate appropriate to the project.

Features of the Shadow Bid

The Shadow Bid's features will typically include the features listed above. However, certain assumptions underlying the Shadow Bid model will differ from those in the PSC model. An example of this is the assumed financing structure: While conventional delivery may involve a debt-only structure, market constraints would require the private sector to utilize both debt and equity.

Development of VfM analysis Model

Step One: Cost of Conventional Delivery and Cash Flow Estimates

To establish cash flow estimates, both the PSC and Shadow Bid models typically consider the amount and timing of the following costs under each procurement method (Conventional and Alternative):

- Capital Costs;
- Operating and Maintenance Costs;
- Rehabilitation Costs;
- Financing Costs;
- Owner's costs; and
- Inflation.

These costs are estimated and incorporated into the PSC and Shadow Bid models as periodic cash flows.

Competitive Neutrality

It is important to ensure competitive neutrality between the public and private sectors through the assumption of payment of tax equivalents, as well as any other regulatory costs, equivalent to those that would be faced by the private sector. This ensures that the project delivery decision is not skewed by such impositions.

Accounting for Non-Cash Items

Note that the PSC should be a cash flow analysis and therefore non-cash items, notably asset depreciation, should not be incorporated.

Cost Inputs

Capital cost inputs to the financial model represent a significant portion of project cash flows and are derived from an indicative design and output specifications for a project. In addition to the capital costs, operating costs, rehabilitation costs and financing costs must also be included. Each of these components is explained in detail in the remainder of this section.

Capital Costs

Capital costs refer to the costs of constructing the asset. The majority of these costs include raw materials, labour and equipment (hard costs), project management fees, consulting fees, and costs associated with securing environmental and regulatory approvals (soft costs).

Capital costs assumed for the PSC are determined based on the existing procurement practices of the Owner involved in the project delivery (in this case, DB).

Preliminary estimates of these capital costs are provided either by the Owner or, preferably, by external consultants to the Owner based on a project's indicative design and output specifications that provide a graphical representation of a possible solution to the performance requirements for a project. The resulting project costs must be based, at a minimum, on the following:

- An estimate prepared by a professional quantity surveyor (QS) based on an indicative design;

- Preliminary project schedule and spend profile; and
- Outline performance specifications.

The resulting estimate should be documented in current dollars and then escalated to match the project schedule. The accuracy of the estimate, expressed as a percentage (+/-), should be highlighted. These capital costs and assumptions should be continually re-validated and updated in order to reflect any time delays, changes in the construction environment, or any changes in project scope.

As capital cost estimates at this early stage are based on an indicative rather than detailed design, a contingency is added to the capital cost estimate to account for the design's preliminary nature. Typically, design and construction contingencies are included for all projects, and a contingency on soft costs may also be included.

Capital Cost Efficiencies

Once PSC capital costs are estimated, efficiencies may be included to adjust the Shadow Bid as competition and innovation from the private sector can result in lower construction costs under PPP procurement.

The estimation of potential efficiencies needs to ensure that there is no double-counting of risk that would be addressed in the risk transfer analysis (discussed below), and that any estimated efficiencies are reasonably precise in order to have validity.

To achieve this, it is necessary to define amounts under consideration as either an efficiency or a risk in order to avoid duplication. A general distinction is that efficiencies in the construction phase are the product of competitively bid design and construction approaches that can result in a lower cost than the estimated base cost. This lower cost would result in an adjustment to the base cost budgets.

Operating and Maintenance Costs

Operating costs refer to costs incurred in operating and maintaining the asset and performing the services that are included within the project scope. Operations and maintenance costs include the cost of inputs, service provider wages and salaries, and other related expenses that are likely to be incurred.⁷ These costs will vary from project to project.

Different terminology is used to describe operating costs. For instance, in the education and health care sectors, operating costs are known as facility management costs, and are not directly associated with students or patients. Examples of facility management costs include: housekeeping, food services, security, laundry and linen, waste management, and physical plant utilities, among others.

In the health care sector, a second type of operating cost pertaining to services provided directly to patients is known as clinical services. Examples of clinical services include: laboratory work and diagnostics, allied services, medical affairs, general administration, and planning, among others. Responsibility for these services is not transferred to the private sector, and consequently, the associated costs have typically been excluded from both models as they remain costs incurred by the government regardless of the procurement option selected.

In the transportation sector, operating costs refer to the costs of services required to keep the road, bridge or transit line open and available for use. Examples of these costs include: incident management, debris removal, snow or mud removal and road condition reporting, among others. Depending on whether or not these are part of project scope, these costs may or may not be included in the PSC and Shadow Bid. If they are not in scope, then they are considered equal and not included.

Methods for estimating operating costs also differ slightly from sector to sector. In the case of facility replacement in the accommodations sectors (health care, education), the client estimates operating costs by refining the current operating budget for facilities to be replaced in order to incorporate changes in programming and/or demand levels for services. This may also include expected increases in facilities management costs due to an increased size of facilities and/or any expected efficiencies resulting from design improvements. In the

⁷ Related costs may include: employee entitlements, insurance, training, development, travel, direct management costs, costs of providing ancillary services such as cleaning and catering, overhead costs, energy, equipment, administrative, electricity, etcetera.

transportation sector, operating cost estimates are generally based on relevant precedent projects, and the costing model is prepared on the basis of public sector operation.

Rehabilitation Costs

Rehabilitation costs represent the investment incurred on an ongoing and/or periodic basis during the course of the concession period to maintain assets according to agreed upon standards. Examples of rehabilitation activities include roof or window replacement for buildings, and bridge deck and road resurfacing for highways. Rehabilitation costs may also be referred to as lifecycle costs or re-capitalization costs, depending on the sector.

The analysis of rehabilitation costs during the VfM stage is preliminary in nature; however, there is generally sufficient information available to establish an estimate of these costs for a project. The amount and frequency of rehabilitation investment for a particular project needs to be determined since optimum lifecycles differ based on asset classes. The costs associated with these estimates are typically provided by client engineers and/or external QS experts, and can be based on available data from past projects. These estimates form part of the initial construction cost estimate and assumed asset condition requirements that form part of the project agreement.

Lifecycle Cost Efficiencies

As is the case with the development of the construction efficiencies discussed earlier, efficiencies related to operations, maintenance and rehabilitation (“OMR”), or lifecycle, can form an integral part of the recommendations presented in a procurement analysis. Such efficiencies can be determined based on a detailed review of existing PSC lifecycle budgets, and comparing them to current market place experience and practice to either confirm estimates or identify cost areas where efficiencies would be expected.

Once developed, such efficiencies inform the overall value-for-money proposition and benefits of a particular procurement method. To be considered accurate, efficiencies should be explored within the specific context of the project and the capacity, capabilities, policies and operating practices of the owner. As with capital cost efficiencies, OMR cost efficiencies need to be carefully considered to ensure that adjustments do not double count amounts included in the risk analysis.

Incorporating Efficiencies into the Analysis

To appropriately incorporate construction cost and lifecycle efficiencies into the VfM analysis, all potential efficiencies should be estimated at the same time and by the same people as a means of avoiding duplication. Generally, construction efficiencies are estimated by the project team and consultants together. If construction efficiencies are identified under a PPP model, the total of these estimated efficiencies is subtracted from the QS construction cost estimate for the PSC. This adjusted cost estimate then becomes the construction cost estimate for the Shadow Bid.

In a similar way, anticipated lifecycle cost efficiencies identified under a PPP are subtracted from the projected lifecycle cost estimates based on traditional procurement.

It is important to consider that in identifying efficiencies, there may be occasions where a PPP approach results in an added cost, or negative efficiency, in which case it should be netted out of the overall capital or lifecycle adjustments. For example, in constructing infrastructure that is part of a broader network (e.g., a bridge), the cost associated with maintaining it as a stand-alone item might be greater than incorporating it into a broader maintenance program already underway for the rest of the system. In such a case, a percentage inefficiency would be determined based on localized maintenance, and a corresponding adjustment would be added to the base cost estimate under a PPP to properly reflect this in the comparison.

Financing Costs

Financing costs are the costs associated with arranging financing for a PPP with debt and equity, and can include items such as arrangement fees, commitment fees, and swap credit premiums. These costs need to be incorporated into the Shadow Bid as cash flows.

Macquarie has assumed that debt financing is obtained either through bank debt or bonds in a typical PPP. When bank debt financing is used, a lender approves the maximum amount of debt for a project, and draw-

downs occur throughout the construction period until this maximum is reached. Interest is accrued periodically on the outstanding balance as the debt is drawn down through the construction period, with a commitment fee applied to the unused portion. When construction is complete and service payments to the private partner begin, the debt is repaid via fixed payments of principal and interest.

Alternatively, when bond financing is used, the full amount of the required funds is raised up front and interest starts accruing right away. To lower overall carrying costs of bonds, the private sector may borrow several tranches of debt over the construction period. The repayment of bonds is similar to bank debt financing, as fixed payments of principal and interest are paid after project construction is complete.

Equity providers structure their investments to be as efficient as possible. In addition to conventional equity investment, an efficient structure may also include a letter of credit or an equity bridge loan as a means of financing construction. Payments to equity holders are not constant, with the Shadow Bid allowing for a minimum equity return to be specified. This required equity return becomes the cost of equity to the project and is the internal rate of return (“IRR”) to the equity investor.

Owner’s Costs

Owner’s costs are project costs incurred by the project owner, and can include:

- Property acquisition;
- Owner’s project team and governance costs; and
- Advisors: technical, legal and financial.

Since these costs are retained by the owner, the private sector does not account for them in their bids and, therefore, they do not appear directly in the financial models. They must be included in the overall project budget, however, to ensure it is complete.

The cash flow impact of the owner’s costs on the overall project budget will differ depending on whether a project budget is based on a PSC or on a Shadow Bid. For a project based on the PSC model, the owner’s costs are typically spread throughout the design and construction phases. In contrast, a project based on the Shadow Bid model will see a significant part of the owner’s costs spent before the project starts construction as the owner will typically spend more during the procurement process, both in choosing the best proponent and in drafting a project agreement. Following financial close, however, until the end of the project agreement, budgeted Owner’s costs for a project based on Shadow Bid can be considerably lower as the owner is only required to manage a single contract (i.e. the project agreement).

Although the upfront procurement costs may be less for a project based on a PSC, the cost of ongoing contract administration is typically higher because the government is responsible for administering many different procurement contracts, and the ongoing contract management of these agreements and associated interfaces can be significant and costly. It should therefore not be assumed that the owner’s net present cost (“NPC”) is greater for a project based on a Shadow Bid than for the same project based on a PSC.

The owner’s costs for a project under a PSC and Shadow Bid typically include the following as set out in the figure below.

Figure 14 – Owner’s Costs

PSC	Shadow Bid
Property	Property
The cost of competitive selection for all contracts, including the selection of a designer, builder, operator and maintenance provider	The cost of the competitive selection process (Request for Qualifications through to Financial Close)
Public sector project management costs through to the commencement of operations	An allowance for partial compensation, if applicable, for unsuccessful proponents
The long-term cost (20 to 40 years) of managing operating contracts (i.e., plant maintenance and facilities management services)	Public sector project management costs through to the commencement of operations

In both the PSC and the Shadow Bid, Owner's costs can be grouped according to the four main phases of a project in which they occur:

- Desirability Study: Feasibility study through to the completion of the Desirability Study;
- Procurement: Procurement costs, including indicative design costs incurred after completion of the Desirability Study, through to required approvals, and up to commencement of construction;
- Construction: Construction management costs; and
- Operations: Operations management costs.

Each of these phases and associated costs are described in more detail below.

Figure 15 – Owner Phases and Associated Costs

Phases	Cost Description
Desirability Study Phase Costs	Costs are incurred by the Owner to develop a feasibility study that justifies undertaking the project, as well as the detailed analysis required for the Desirability Study to support a recommended procurement option.
Procurement Phase Costs	<p>Procurement phase costs are the costs incurred by the Owner from completion of the Desirability Study up until the start of construction and are comprised of costs associated with the following key activities:</p> <ul style="list-style-type: none"> – Preparing and issuing procurement documents (request for qualifications and request for proposals); – Obtaining an invitation to bid; – Drawing up a contract; – Evaluating proposals; – Negotiating with the preferred proponent; and – Dealing with any deviations from the contract conditions. <p>In addition, projects can typically incur the following costs:</p> <ul style="list-style-type: none"> – Cost estimates (capital and lifecycle); – Geotechnical investigation; – Cost of legal advisor; – Indicative design; – Information technology (e.g., data room); – Asset studies; and – Public sector internal costs. <p>Owner's costs that are unique to the Shadow Bid include:</p> <ul style="list-style-type: none"> – Partial compensation (honorarium); – Business/financial advisor; – Procurement advisor; and – Additional legal advice to develop the project agreement. <p>These advisory elements are necessary to acquire the appropriate financial, procurement, and legal expertise required to ensure the final project agreement properly addresses all aspects of successful project completion and ongoing operations for up to 40 years.</p> <p>Indicative design costs are included in procurement cost estimates since they are incurred during the project definition phase. For a PPP, an indicative design is usually completed by both internal and external consultants, to a sufficient degree that they can support the development of project costs and provide proponents with an understanding of facility requirements. The final, detailed design is completed by the private sector partner.</p>
Construction Phase Costs	Construction management costs are incurred by the party responsible for overseeing work done during the construction phase of a project. These costs are less intensive for the public sector following procurement as a PPP, as the partner bears the costs associated with overseeing

Phases	Cost Description
	<p>construction, contract administration and for the majority of the quality assurance work. Although there may continue to be some legal and advisory costs related to implementing the project agreement, the role of the owner is reduced and requires a smaller team to administer the contract and monitor the construction of the project on behalf of the government. This monitoring includes the cost of an independent certifier to verify completion of the project, and is done to ensure the requirements of the Project/Concession Agreement are met.</p>
Operations Phase Costs	<p>Operations management costs are the ongoing administrative costs to the government of managing the project agreement with the PPP partner during the operations phase. These costs are less significant under either procurement approach relative to the design and construction period; however, under traditional procurement the government will incur more direct costs as it operates the infrastructure itself, or contracts the work with one or more companies. Under the Shadow Bid model, the public sector's role is again limited to monitoring the performance of the private partner operating the facility, according to the project agreement.</p>

Inflation

Best practice on the selection of the discount rate calls for the use of a nominal discount rate⁸. In order to be consistent, the cash flows in both the PSC and Shadow Bid need to be nominal as well. Including an estimate for inflation is a key component of any cost estimates that are included to avoid undervaluing true project costs. Depending on the category of cost, specific inflation indices are used. For construction costs, a construction escalation index is estimated, usually by a QS, and is used to inflate construction-related cash flows. Construction escalation should assume expenditures are made at the mid-point of the construction period, or should be inflated according to the spend curve provided by the QS. Consideration can also be given to the applicability of escalating specific cost categories if there is sufficient, documented rationale for doing so.

To account for the effect of inflation on the long-term cost of operations, an index such as the consumer price index (CPI) is applied as part of the cost estimate of this component of the overall project cost.

Step Two: Risk Adjust Cash Flows

Adjustments are necessary to account for differences between traditional public procurement and PPP procurement. The Shadow Bid will reflect the fact that the private sector directly incorporates insurance costs and tax impacts into the model, in addition to the estimated cost of project risks that are transferred to the private partner. These items are added as adjustments to the PSC as public sector procurement does not directly account for them. In addition, an adjustment for retained risk is added to the PSC based on the expected cost of the project risk that is not transferred to a private partner, and is instead retained by the public sector (retained risk) under the PSC structure. A similar adjustment is made to the Shadow Bid, adding the expected cost to the PPP of the risks that are transferred to the private partner.

Competitive Neutrality

The aim of the competitive neutrality adjustment is to reflect financial benefits and costs that are not equally available to bidders under different procurement models. Competitive neutrality ensures that a like-for-like comparison is being made in any value for money analysis which compares the PSC and Shadow Bid options. If competitive neutrality adjustments are not made then the PSC may be understated in some areas and will not necessarily reflect the true cost to government of traditional procurement. This may result in the selection of a sub-optimal procurement solution.

The two most common competitive neutrality adjustments made are for insurance and taxation, both of which are discussed in this section.

Insurance

When private sector companies take on risk they typically seek to insure against this risk if insurance is available and if it is not too costly. To make the PSC and Shadow Bid comparable in situations where the owner self-

⁸ A nominal, or market, Discount Rate takes into account the effect of inflation.

insures (bears the cost) when a retained risk occurs, an adjustment is made to the PSC model for insurance premiums paid by the private sector, based on current insurance cost estimates and insurance costs from precedent projects. These premiums reflect the actual value of these risks if they were retained and self-insured by the public sector under traditional procurement.

Taxation

Under the Shadow Bid model, the private sector pays taxes to the government based on the project revenues and expenses. Taxes are thus additional costs to the bidder and are included in the Shadow Bid. In contrast, if the government procures the project through traditional means, during the operating period it will not receive the tax revenue nor the secondary benefits from the federal taxes collected that it would if the private sector had been awarded the project. These foregone taxes represent an opportunity cost to the public sector. An adjustment is therefore made to account for the foregone taxes in order to accurately reflect the total cost of the PSC.

Accounting for Risk

Action	Description
Construct a Risk Matrix	<p>The starting point when accounting for risk in a PSC analysis should be the detailed risk matrix for the project, in order to define the risk transfer assumptions, which will influence the differential between the private sector and PSC cost of delivery. Only those costs and risks to be transferred to the private sector under the private sector delivery method should be included in differentiating the private sector cost of delivery and the PSC costs.</p> <p>The steps in developing the risk matrix for the PSC are:</p> <ul style="list-style-type: none"> — Construction of a risk matrix, with categories of risks that may be encountered; — Identification of the specific risks; — Quantification/calculation of the consequences of the risks; — Estimation of the probability of the risk occurring; — Valuation for the risks; and — Allocation of the risks.
Employ a risk adjusted discount rate	<p>This is achieved by employing a discount rate that reflects a fully commercial capital structure that is exposed to the risks of the project, i.e. a level of debt and equity which optimizes the value of the project, while maintaining an investment grade credit rating for debt. The appropriate discount rate is discussed in Step Three: Calculate NPV.</p>
Adjust the dollar values of the cash flows	<p>This requires an estimate of the expected cost of risks that could potentially crystallize over the life of the project. The PSC should be able to distinguish between the expected cost of risks retained by government and those transferred to the private sector. This is most appropriate for a PPP. A major issue to resolve is whether the current estimated cost of construction is an appropriate basis for the PSC, since it does not explicitly price risks that the private sector proponent is required to bear, e.g. insurance, bonding and contingency margin.</p>
Account for Residual Value Risk	<p>The residual value of the infrastructure asset at the end of the concession period will need to be taken in account and estimated, if there is to be any difference in the quality of the infrastructure asset under public and private sector delivery. Private sector delivery will require the hand back of the infrastructure asset in a pre-specified condition, intended to ensure that the asset continues to deliver acceptable service levels without major capital upgrades and/or a major increase in ongoing costs over a “reasonable” period.</p>
Recommended Approach	<p>A certain degree of caution is required when contemplating both an adjustment of cash flows and an adjustment of the discount rate. It is recommended that any explicit costs or risks that the private sector must incur in undertaking the project (e.g. insurance) should be used to adjust the cash flows, while the level of risk associated with the project should be used to adjust the discount rate.</p> <p>A review of initial estimates of project capital and operating costs is strongly suggested in order to ensure that the risks proposed to be transferred to the private sector are adequately reflected in these cost estimates.</p>

Step Three: Calculate NPV

This step determines the Net Present Value (NPV) of the PSC by discounting the risk-adjusted cash flows. The NPV is then used in the quantitative evaluation of the bids received. The primary issue in calculating the NPV of the PSC is the selection of an appropriate discount rate.

Discount Rate

An important consideration in the quantitative analysis of procurement options is the choice of discount rate. The discount rate reflects the time value of money as well as any risk premium associated with a project, and is determined based on the risk profile of a project and prevailing market conditions. Discounting enables nominal project cash flows⁹ that differ in terms of timing and amount to be discounted back to a common reference date, usually to their present value. Discounting in this way allows procurement methods with different cash flow impacts to be compared on a like-for-like basis. Comparing competing options in this way provides an objective means of determining the approach that provides the best value in terms of cost.

There are a number of problems that can result from the selection of an inappropriate discount rate. A discount rate that is too low may make it unrealistic for PPP (Shadow Bid) delivery to ever beat the PSC. This can be managed by adding a risk premium to costings under the PSC, while a discount rate that is too high may make it too easy for the private sector to beat the PSC hurdle.

The choice of discount rate can skew bids. If the discount rate selected is too low, bidders will be incentivized to front end payments. If it is too high then CDOT will risk paying more than it needs to.

There is a debate over whether to use real or nominal rates. The major advantage of real rates is that they are a stable basis for fixing the discount rate over a long period of time.

The UK has typically used a discount rate of between 6-8% real for analysis of the PSC. This is neither the cost of public sector borrowing nor any calculation of the private sector WACC. Instead it reflects a risk adjusted rate based on opportunity costs of public sector borrowing. The real rate of 8% was used to evaluate the first four shadow tollroads in the UK. This was then reduced to 6% real when the savings from these roads based on the successful bids were perceived to be unreasonably large. However, the problem remains that the public sector cost of borrowing reflects the entire portfolio of government assets, liabilities and revenue streams, whereas the private sector will be borrowing based on the specific revenue stream of the project.

Discount Rate Selection

There is considerable debate as to which discount rate should be used when developing the PSC and evaluating bids. Potential rates include:

- The estimated long-term cost of funds by CBE which is used to discount both the PSC risk adjusted and the private sector cash flows;
- A risk adjusted rate which reflects both CBE's cost of capital and the risk of the Project; or
- The full estimated private sector WACC for the Project.

Long-term Cost of Funds

Some jurisdictions use the public sector's estimated long-term cost of funds to discount their PSC because the PSC incorporates discrete adjustments for risk in the model's numerator cash flows. Since cash flows rather than the discount rate are adjusted to reflect risk, both the PSC's risk-adjusted cash flows and the private sector cash flows could be discounted by CBE's long-term cost of funds.

Macquarie does not recommend this approach as the use of CBE's cost of capital would result in a cost of capital advantage that would indicate that CDOT should theoretically take on all public and private projects.

Risk Adjusted Discount Rate

The risk adjusted discount rate is calculated to incorporate the risks inherent to the project into the discount rate. To calculate the risk adjusted discount rate, a debt "guarantee" premium reflecting the margin between the

⁹ Nominal cash flows reflect the anticipated impact of inflation and/or construction escalation on the periodic costs of the project.

expected project credit rating and the CBE's credit rating should be added to the public sector cost of borrowing. The adjusted public sector cost of capital factors out the implicit government guarantee on the debt so that it is comparable on a stand-alone basis.

The project discount rate is not easy to calculate, however an assessment can be made of the cost of debt at the likely credit rating of the project, on a stand-alone basis, compared to the cost at CBE's rating. It is important to note that the structure of the debt (term, amortization, coverage ratios, reserves) is at least as significant as the actual cost. When calculating the risk adjusted discount rate, the cost of equity is not adjusted because it reflects the risk of the Project. In most circumstances this adjusted overall cost of capital should be close to the estimated WACC in the Shadow Bid.

While the use of a risk adjusted discount rate is recommend over the use of CBE's cost of capital, it still does not represent a like-for-like risk comparison.

Private Sector WACC

There is a strong argument that the PSC should be based on the full private sector WACC. For example, for road projects, Macquarie would argue strongly that the public sector discount rate should equal the private sector WACC. This is because payment timing drives risk transfer and because the WACC represents the best market proxy for the risk of the project. If a low discount rate is used then it incentivizes payment as early as possible in the project to achieve the lowest cost at the expense of effective risk transfer. Use of the WACC encourages the most efficient optimization of project risks.

Macquarie would recommend the use of the private sector WACC as it reflects the ideal risk-return relationship effectively portraying the inherent retained risk in the project from the governments standpoint.

PSC Structure

The structure of the PSC after determining the cost of public sector delivery, adjusting for risk and calculating the NPV after selecting an appropriate discount rate would be as illustrated below:

Figure 16 – Project NPV Cost Analysis

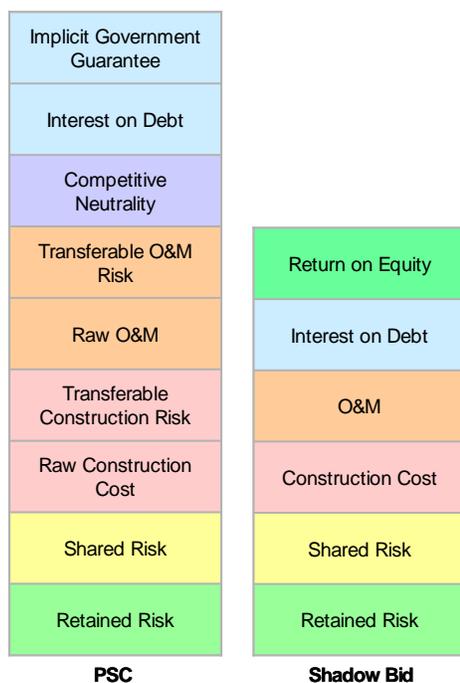


Figure 16 above is an illustration of the PSC and Shadow Bid cost breakdown. Some items are self explanatory, while other parts require some clarification. The shared risk represents the risk associated with the project that is shared by both parties, such as environmental risk. The raw O&M cost in the PSC represents the direct costs to

Government if they were to take on the task in-house. The Transferable O&M Risk represents the transferable O&M risk retained by Government when the O&M is undertaken in-house. The O&M costs in the Shadow Bid represents the O&M costs if it were undertaken by the private sector. The cost, which includes O&M related insurance and bonding costs, are smaller than the combined transferable and raw O&M costs, because the private sector can better manage the risk. A similar concept applies to the construction cost. Competitive neutrality in the PSC represents the adjustment required to factor in costs borne by the private sector simply because they are a private company. This primarily consists of a variety of taxes. The retained risk represents the risks (costs) retained by government independent of how the project was delivered.

The NPV of costs are arrived by discounting expected cash flows, at the risk-adjusted rate of return, detailed above.

Limitations of a PSC Financial Model

The PSC is a quantitative financial benchmark with inherent limitation because:

- It requires costs to be estimated over the life of the project, which are difficult to forecast;
- It is highly sensitive to the discount rate;
- A separate analysis is still required to evaluate any qualitative aspects of the project;
- Estimating the impact of the risks on costs and revenues over the life of the asset is complex and somewhat subjective – some risks cannot be reasonably quantified; and
- Its usefulness is limited to the extent and frequency with which it is updated

Therefore, the PSC must be subject to sensitivity and scenario analysis. Furthermore, once the extent to which the PSC will be updated is determined, we must ensure the PSC is sufficiently flexible to allow new information to be incorporated, thereby enhancing the integrity of the PSC as a benchmark.

Evaluation Process

Quantitative Evaluation Using a Shadow Bid

In undertaking a quantitative analysis of the proponent's bids, a comparison between the bid received and the model upon which the decision to be based is required. An illustrative example of the breakdown of costs used to calculate the NPV can be seen in the previous section. The quantitative analysis can be approached in one of two ways.

Firstly, the bid could be compared to the Shadow Bid. This approach to analysis sees the PSC updated for material changes only, resulting in its limited use during the quantitative evaluation process. Under this rationale, should the bid received prove to be more competitive than the Shadow Bid, the proposal would be accepted. The complication created by this approach, however, is the potential to reject bids that are less competitive than the Shadow Bid, despite the fact that they still create value for the Government if they were compared to an updated PSC. The potential exists for an otherwise competitive bid to be inadvertently rejected following an analysis against the Shadow Bid.

The second approach is to maintain both the Shadow Bid, and PSC throughout the competitive procurement process. The bids are compared against the Shadow Bid initially, however should none of the bids satisfy the requirements under the Shadow Bid but are considered competitive in comparison to the PSC, then the proposal should be accepted. This approach is generally recommended, as it eliminates the potential for rejection of competitive bids, should there be any inaccuracies in the forecasting of the Shadow Bid.

We recommend that bidders are required to submit full financial models underlying their bids, preferably in a format which does not differ significantly to the Shadow Bid, in order to facilitate a comprehensive assessment of each bid's risk profile.

It is important to note that the purpose of the PSC and Shadow Bid is not to necessarily be the sole evaluation criterion of bids. The main purpose of the PSC is to compare bids in general against the public sector cost of delivery. Any bid, which is superior to the Shadow Bid, should be capable of acceptance. However, a bid that is

superior to another bid within the PSC framework should not necessarily be the preferred bid as there will be other evaluation criterion outside the scope of the PSC.

Disclosure of PSC and its Relationship with Evaluation Criteria

The key elements of the PSC and the evaluation can be disclosed to bidders so that they are aware of the objectives of Government. Disclosure should be undertaken to the extent that it will assist the private sector's bid preparation process and result in higher quality and better value bids to the government. The full PSC will be made public after the deal has been concluded.

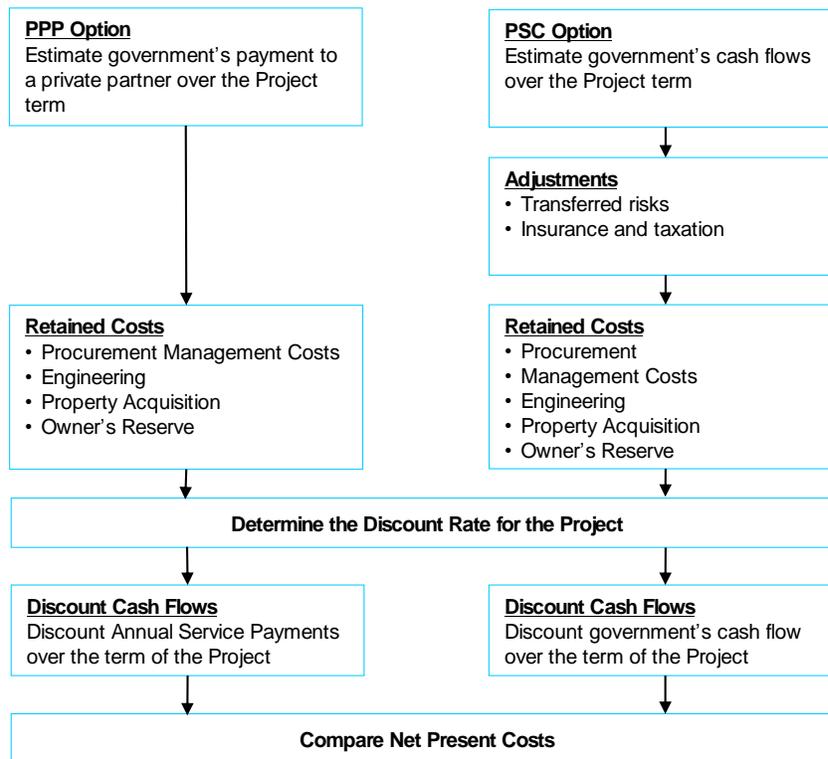
Term

The length of the project varies by sector and by project, and includes both the construction and operating period. Often, the length is construction plus 30 years of operations, but the operations period can vary, depending on the needs of the project and the expected life of the asset the PPP is to deliver.

Summary

Figure 17 below summarizes the process described for determining the quantitative value for money by comparing the NPC of the alternative cash flows for a project.

Figure 17 – Determining the NPC of Alternative Procurement Approaches – Summary



Interpreting the Results

This section describes how the outcomes of the quantitative analysis are interpreted and integrated into the overall results of the VfM process. These results are then utilized for affordability analysis.

Value for Money Context

The purpose of the quantitative analysis of procurement options is to support the identification of the procurement model offering the best overall value to taxpayers. As value for money includes both qualitative and quantitative elements, the procurement option ultimately selected will be the alternative deemed to best meet the criteria established by the project team. These criteria are determined based on the desired outcomes of a

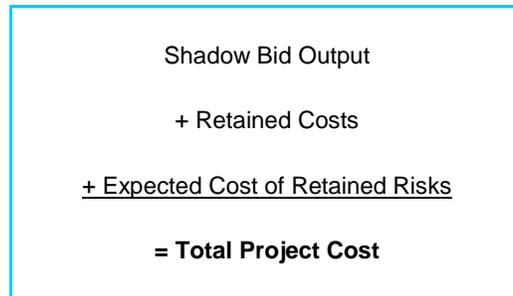
project, and are used to assess a particular procurement option’s ability to support the project, with quantitative value as one key element. The inclusion of qualitative criteria in the value for money assessment means it is possible that the procurement option with the lowest NPC may not necessarily be the preferred option.

Link to Project Budgeting

The output from the Shadow Bid is an important element of a comprehensive project budget, but does not comprise the complete project budget¹⁰. A project budget is defined once the preferred procurement option has been identified, and includes the total amount of funding needed to complete the project within its proposed scope, including both capital and operating components. When constructing the PSC and Shadow Bid, only direct costs that vary based on the type of procurement option are considered in order to simplify the scope of the analysis. Other important budget components such as the owner’s retained costs are generally not included in the models. These need to be estimated by the project team separately to be included with the Shadow Bid model output in order to create a complete project budget.

Figure 18 below illustrates how output from the Shadow Bid model forms part of the overall project budget.

Figure 18 – PPP Project Budget Components



¹⁰ The output from the Shadow Bid model for the purposes of a project budget would be the stream of annual service payments over the concession period, and not the net present cost of the PPP option.

A.2 Appendix: Example Projects

Design Build

- 183-A Turnpike - Austin, Texas
- Anton Anderson Memorial Tunnel - Porter-Whittier, Alaska
- Denver Union Station - Denver, Colorado
- E-470 Tollway - Denver, Colorado
- Central Texas Turnpike System (SH 130, Segments 1-4) - Austin, Texas Metropolitan Area
- Cooper River Bridge Replacement - Charleston, South Carolina
- Hiawatha Light Rail Transit - Minneapolis/St. Paul, Minnesota
- I-15 Corridor Reconstruction Project - Salt Lake City, Utah
- Intercounty Connector - Maryland
- Iway (I-195 Relocation Project) - Providence, Rhode Island
- Missouri Safe and Sound Bridge Improvement Program - State of Missouri
- Ohio River Bridges Downtown Crossing - Louisville, Kentucky/Southern Indiana
- Reno Transportation Rail Access Corridor (ReTRAC) - Reno, Nevada
- Route 3 North - Northern Metropolitan Boston, Massachusetts
- SR 91 Corridor Improvement Project - Riverside County, California
- Tren Urbano - San Juan, Puerto Rico
- Triangle Expressway - Raleigh-Durham, North Carolina
- U.S. 36 Managed Lanes / Bus Rapid Transit Project: Segments 1 and 2 - Denver Metro Area, Colorado

Design Build Finance

- 95 Express – Miami, Florida
- I-4 / Selmon Expressway Connector - Tampa, Florida
- I-485 Charlotte Outer Loop - Charlotte, North Carolina
- Innerbelt Eastbound Bridge - Cleveland, Ohio
- I-75 Roadway Expansion (iROX) - Collier and Lee Counties, Florida
- Northwest Corridor Project – Atlanta, Georgia
- U.S. Route 460 Corridor Improvements Project - Petersburg to Suffolk, Virginia

Design Build Finance Operate Maintain (Availability Pay)

- Eagle Project - Denver Metro Area, Colorado
- I-595 Corridor Roadway Improvements - Broward County, Florida
- Ohio River Bridges East End Crossing - Southern Indiana/Louisville, Kentucky
- Port of Miami Tunnel - Miami, Florida
- Presidio Parkway - San Francisco, California

Design Build Finance Operate Maintain (Real Toll)

- Downtown Tunnel / Midtown Tunnel / MLK Extension - Cities of Norfolk and Portsmouth, Virginia
- Dulles Greenway - Loudoun County, Virginia
- I-495 Capital Beltway HOT Lanes - Fairfax County, Virginia

- IH 635 Managed Lanes - Dallas County, Texas
- North Tarrant Express Segments 1 and 2A - Dallas-Fort Worth Metroplex, Texas
- North Tarrant Express Segments 3A and 3B - Dallas-Fort Worth Metroplex, Texas
- SH 130 (Segments 5-6) - Austin, Texas Metropolitan Area
- South Bay Expressway (formerly SR 125 South) - San Diego County, California
- Southern Connector - Greenville, South Carolina