Ontario

INFRASTRUCTURE ONTARIO

ASSESSING VALUE FOR MONEY

A GUIDE TO INFRASTRUCTURE ONTARIO'S METHODOLOGY

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This is a technical document. Definitions for many concepts and terms may be found in the glossary at the end.

Table of Contents

Introduction

OBJECTIVE OF THE GUIDE

Infrastructure Ontario (IO) delivers public infrastructure projects using a project delivery model called Alternative Financing and Procurement (AFP). This document provides the detailed methodology by which IO determines if value for money is demonstrable by procuring a project using AFP. A value for money analysis consists of a comparison between the total costs of delivering an infrastructure project using the traditional public sector project procurement model and AFP.

TYPES OF AFP PROJECTS DELIVERED BY IO

Currently IO uses several AFP models to deliver projects. These are the Build-Finance (BF), Build-Finance-Maintain (BFM), Design-Build-Finance (DBF), and Design-Build-Finance-Maintain (DBFM) models. The current list of projects assigned to IO consists of buildings of various types (hospitals, courts, etc.). The methodology set out in this guide therefore relates to BF, BFM, DBF and DBFM buildings.

WHAT IS "VALUE FOR MONEY"?

In simple terms, a value for money (VFM) analysis refers to the process of developing and comparing the total project costs, expressed in dollars measured at the same point in time, related to the following:

1. **Traditional Project Delivery:** Estimated costs to the public sector of delivering an infrastructure project using traditional procurement processes (under which total estimated costs are known as the ***public sector comparator, or PSC***), and
2. **Alternative Financing and Procurement:** Estimated costs to the public sector of delivering the same project to the identical specifications using AFP (under which total estimated costs are known as the ***adjusted shadow bid, or ASB***).

The difference between the public sector comparator and the adjusted shadow bid is referred to as the value for money. If the adjusted shadow bid is less than the public sector comparator, there is positive value for money by procuring a project using AFP.

WHEN AND HOW IS VALUE FOR MONEY ASSESSSMENT USED?

STAGE #1 - Authorization to release the Request for Proposal (RFP)

The release of all RFPs by IO must be approved by its Board of Directors. The IO Board does not approve release of an RFP unless, among other factors, positive VFM is demonstrated by procuring a project using AFP.

STAGE #2 - Authorization to enter into the Project Agreement

Upon close of the RFP process, bids are evaluated by an evaluation committee. The **preferred bid** is then compared to the public sector comparator and presented to the IO Board of Directors. At this point the PSC is updated to reflect the most current cost information. Again, the IO Board of Directors will not approve proceeding with AFP procurement unless positive VFM is demonstrable using AFP.

STAGE #3 - Publication of the value for money analysis

After the project agreement has been finalized, IO releases a public report that contains the final VFM analysis, along with details on the project, the procurement process and the project agreement. The objective of the report is to provide the public and others with an understanding of the project and the basis for the decision to deliver the project via AFP.

How is Value for Money Estimated?

The value for money analysis is prepared in accordance with the methodology detailed in this document by an external advisory firm with relevant experience, such as a professional services firm, in collaboration with IO management for presentation to the IO Board of Directors.

The VFM assessment is based on detailed project specific information from multiple stakeholders. This information is used to develop two financial models:

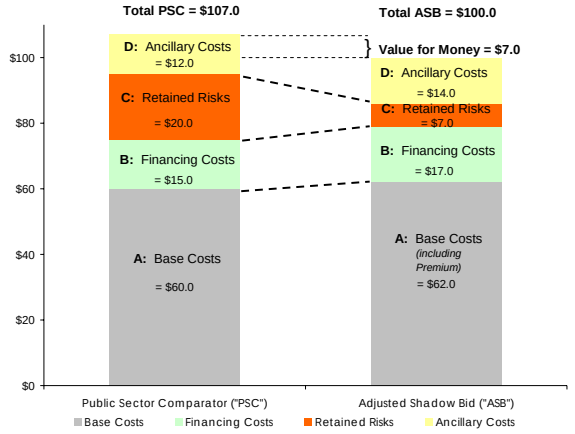
Model #1 Public Sector Comparator (PSC)	**Model #2 Adjusted Shadow Bid (ASB)**
Total estimated costs to the public sector of delivering an infrastructure project using traditional procurement processes	Total estimated costs to the public sector of delivering the same project to the identical specifications using AFP

The difference between the estimated total project costs under each model is the VFM.

In the illustrative BF VFM analysis (figure #1), the PSC is shown as the stacked bar on the left of the graph and the ASB is shown as the right hand bar. Both are expressed in terms of dollars measured at the same point in time.

Figure #1

Illustrative BF VFM ($'s millions):



The comparative cost components will vary slightly in magnitude between the two procurement methods (as shown by the coloured segments in the figure above). The difference between the estimated total project costs is the VFM and is calculated as:

Sample Value for Money Calculation

$$\frac{\text{(Traditional Project Costs) - (AFP Project Costs)}}{\text{(Traditional Project Costs)}}$$

=

$$\frac{\text{(Total PSC) - (Total ASB)}}{\text{(Total PSC)}}$$

=

$$\frac{\$107.0 - \$100.0}{\$107.0}$$

=

$$\frac{\$7.0}{\$107.0}$$

= 0.0654

Stated in percentage terms, the VFM for the sample project above is an estimated 6.5%

Under AFP, the estimated base costs (including premium) and the estimated financing costs are together known as the **shadow bid**. It is when the other cost components such as retained risks and ancillary costs are added to the shadow bid that one arrives at the adjusted shadow bid (i.e. adjusted for risks and ancillary costs).

When bids are received, they consist of base costs (including premium) and financing costs (i.e. exactly the same components as the shadow bid). When reassessing VFM at this stage, the shadow bid is replaced by the preferred bid, and adjustments are once again made for risk and ancillary costs to arrive at the adjusted preferred bid. This adjusted preferred bid is compared to the updated PSC.

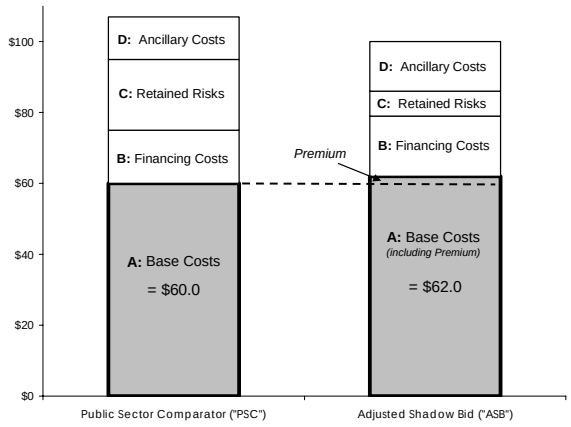
The following sections will detail the methodology that is followed on IO projects to develop each of the cost components that make up the PSC and ASB, leading to the VFM calculation. The cost components in the VFM analysis include only the AFP portions of the project costs. Non AFP related project costs, such as land acquisition costs, that would be the same irrespective of the delivery method are excluded from the VFM calculation.

Estimating the Cost Components

The method of calculating each of the individual cost components is as follows.

A. BASE COSTS and PREMIUM

Figure #2



The estimate of base costs generally includes:

- construction costs;
- lifecycle costs[1];
- hard and soft facility management costs[1]; and
- premium (under ASB only)

Unless there are compelling reasons to assume otherwise, the base costs under the PSC and the ASB should be assumed to be identical as a starting point, with the exception that the AFP base costs will include a premium (as shown by the dotted line in Figure #2). This premium is included by the private-sector party as compensation for the added risks transferred to them under the AFP contract.

Where clear base cost advantages to proceeding using AFP can be anticipated or are revealed in bids, they should be factored into the VFM Analysis. A couple of examples may serve to illustrate. Were

[1] Applicable only in projects which include a post-construction maintenance phase

a hospital to consider putting out to tender a fully designed addition project, it might rightfully determine that there were few opportunities for innovation in the actual construction of the project. Consequently, the base construction costs could be assumed to be identical under traditional and AFP delivery. Unless the bids contradicted this assumption, it would underlie the VFM analysis throughout the process. Conversely, were a hospital to consider putting out to tender a project for design, build and maintain, it might assume that there were opportunities for innovation and efficiency in the delivery and operation of the facility under AFP. However, prior to receipt of bids, it might conservatively determine not to factor these into the analysis. Once bids were received, if there were clear bases for using different base costs for the PSC and ASB, such as unanticipated design innovations, construction techniques or operating expenses, the base costs would be different under the PSC and ASB.

Prior to the receipt of bids, the best means of estimating base project costs is to have professional industry experts' estimate the:

Cost element	External Source of Data
Construction Costs	Construction cost consultant
Lifecycle Costs	Lifecycle cost consultant
Facility Management Costs	Facilities management cost consultant

The relevant cost consultants also estimate, based on their industry knowledge and expertise, the magnitude of any premium in respect of risks transferred in connection with the goods or services being procured. The premium, if any, will vary depending upon the degree of risk transfer, as well as market conditions.

The illustrative VFM shows base costs under PSC of $60.0 million, whereas the base costs under AFP are $62.0 million. The cost of $62.0 million under AFP represents $60.0 million for base costs, plus a $2.0 million premium to account for the risks that the public sector has transferred to the private sector.

For the VFM update at the preferred bid stage (stage #2), it is IO's policy to update the PSC with the base costs (after stripping out the embedded private-sector party premium) contained in the preferred bid. Recall that the preferred bid is broken into base costs (including premium) and financing costs. However, the actual bid does not typically break down the base costs (including premium) into base costs and premium separately. It is thus necessary to make an assumption about the magnitude of this embedded premium in the observed costs and so extract it to arrive at the base costs to use for the PSC. Unless there is clear justification to believe that the percentage magnitude of the risk premium has changed since the relevant cost consultant first estimated it, the original assumption about the magnitude of the risk premium (in percentage terms) is used to calculate and back out the premium embedded in the private-sector parties' bid. The resulting base cost information is then used to update the base costs of the public sector comparator while the actual preferred bid information is used to update the costs for AFP procurement. Updating the PSC in this manner is consistent with the principle of using the best cost information available. Information taken from actual bids is considered the most accurate, up-to-date market information available, especially in light of rapidly changing market pricing.

Competitive Neutrality

In certain instances, the base costs under AFP delivery will include a provision for certain taxes and insurance premiums. The equivalent costs will not appear under the PSC, as the public sector may be exempt from paying certain taxes and may "self insure." These perceived cost advantages could be misleading. As a result, an adjustment called the "competitive neutrality adjustment" is required to negate this potentially misleading cost of AFP delivery. The adjustment consists of adding such costs to the PSC. The perceived advantages are misleading because taxes are costs that ultimately result in revenues to the public. It might be possible to distinguish among the various levels of

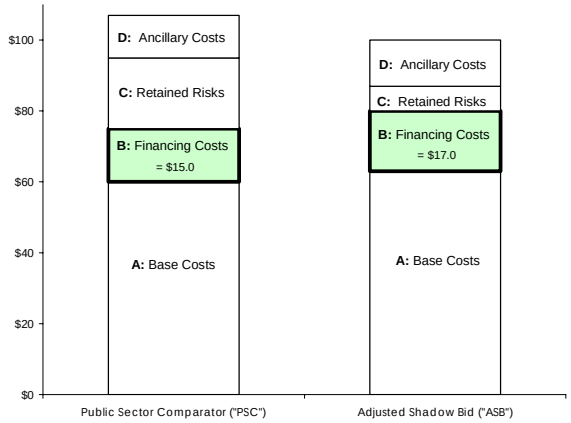
government to whom taxes are paid, so that taxes paid to the Government of Canada were treated differently from provincial taxes. It is IO policy not to draw such a distinction on the basis that tax revenues paid to the Government of Canada also benefit the Province. A similar adjustment is required in respect of insurance. When the government chooses to self-insure, there is a perception that the government has saved on insurance premiums. In fact, the government is taking on risks otherwise covered by insurance, and the government should account for this additional risk. An adjustment is made to the PSC by adding an amount equivalent to the premium otherwise paid by the private sector under AFP to account for the additional risks.

Innovation

Assuming the same base costs under the PSC and the ASB (with the exception of the premium under AFP) leads to a conservative assumption of the value for money under AFP. It is conservative because it assumes that the private-sector party does not introduce any value-added innovations to reduce the ASB. Such innovations can occur when the responsibilities for design, construction, financing and maintenance are assumed by a single party - who will then optimize the trade-offs that are available between these different project cost elements. This is possible in the case of AFP delivered projects where the responsibilities are assumed by a single party, but not in the case of traditionally delivered projects. Until IO has compiled sufficient empirical data regarding the probability and magnitude of such innovations it will assume that the base costs under AFP and ASB are the same (with the exception of the premium). This assumption will be revisited if, as projects are completed, experience indicates that the base costs under AFP are reliably less than under traditional delivery as a result of innovation.

B. FINANCING COSTS

Figure #3



One of the common elements of all the AFP models used by IO is private finance for some period of the project:

Traditional Model	AFP Model
The public sector makes progress payments throughout construction. The public sector incurs an opportunity cost for having paid earlier (payments through the construction period) than under AFP delivery.	Either the government makes one lump sum payment after construction or makes a series of regular unitary payments to pay for the project, starting at substantial completion and stretching over the post-construction term of the agreement. In either case the private party borrows at private financing rates to pay for the project costs until repaid by the public sector.

Figure 3 illustrates how AFP financing costs are typically greater than Traditional financing costs.

Traditional Model Financing:

When projects are built using a Traditional procurement method, the public sector makes progress payments throughout the construction period, and thereafter pays annually for facility maintenance. Depending on which public sector entity procures a project, construction funds are

either wholly or in majority provided by the Province. While the Province may not borrow money directly from the market on a project-by-project[2] basis to make these payments, it incurs an "opportunity cost" of having to pay earlier than it would under AFP (under AFP, payment for construction is delayed until substantial completion or later). The government could have used the funds used to make these progress payments for other public purposes. A key alternative use for the funds, one that can be used to measure this opportunity cost, is to pay down existing public debt (thus avoiding interest payments on the paid-down debt) or alternatively, to avoid incurring additional borrowing costs to finance government expenses. It is important to note that since this financing cost is not directly linked to project-specific borrowing, this financing cost is an "allocated" or "notional cost." This notional public financing cost is calculated at the current Provincial cost of borrowing (the notional public sector financing rate). The Province's cost of borrowing can be estimated through readily available data. IO uses the simple average of yields on provincial bonds with a term of one year or longer as the estimated current borrowing cost (or weighted average cost of capital).

Though the VFM analysis methodology is consistent across the AFP delivery models described earlier, a key difference is the choice of the point in time (referred to as the base date) at which the PSC and ASB costs are compared. This choice has an important effect on how the public sector financing costs are presented in the VFM analysis, though it does not affect the outcome of the VFM analysis.

Since, in the BF or DBF model, the public sector makes payment at project completion (a future date); this is the date that becomes the base date for comparison of PSC and ASB costs. Thus all BF or DBF PSC costs, such as the multiple construction payments made over the construction term, have to be future-valued at the public sector borrowing rate to the base date. The difference between the future value of each construction payment and the construction payment itself represents the notional cost of financing that the public sector incurs as a result of having made the construction payment. For example, assume that the public sector makes a construction payment of $20 million one year into a three-year construction term. Assume further that the public sector borrowing rate is 5% a year. By making the $20 million construction payment, the public sector does not pay down public debt of $20 million. By construction end, this $20 million debt would have grown to $22.05 million (i.e. the future value at 5% compounded annually for two years). Thus the difference of $2.05 million represents the notional cost of financing associated with the construction payment that the public sector made. This calculation is done for each construction payment made by the public sector to arrive at the total notional public sector financing cost that is added to the PSC in a BF or DBF model. The timing of the construction cash flows is estimated and provided by the external cost consultant.

In a BFM or DBFM model, the public sector makes a series of unitary payments to the private sector, starting from construction completion and stretching over the post-construction period (i.e. typically a maintenance term of 30 years). Since there will be not one but many future-dated payments in the BFM or DBFM model, the date on which the RFP closes[3] and all the private-party bids are received is used as the base date for comparison of the costs in the PSC and ASB models. Thus all PSC costs (and ASB costs) have to be

[2] Since the current portfolio of AFP projects assigned to IO represent a very small portion of Provincial indebtedness, and since the current AFP projects are themselves individually relatively small in magnitude, it is reasonable to assume that irrespective of the delivery model, Traditional or AFP, no incremental public sector borrowing would occur solely on account of such projects.

[3] At the VFM publication stage (stage #3), the base date is the date on which financial close of the project is achieved. Costs are contractually locked down at financial close, making it a good point in time for the comparison.

present-valued back to the base date using the technique of discounting and using public sector borrowing rate as the appropriate discount rate[4]. Discounting the payments made by the public sector in the PSC model explicitly accounts for the implied public sector financing cost. To understand why this is so, consider the previous example where a $20 million payment is to be made a year into the future. To finance an expenditure of $20 million in a year's time, the public sector has two equivalent choices. It can either (A) borrow $20 million in a year's time to finance the expenditure occurring then or (B) it can borrow $19.05 million today, invest the borrowed money in an account bearing 5% interest (e.g. buying its own debt that pays 5% interest), earning $0.95 million in interest (= $19.05 x 5%) over the next year so as to have $20 million available just in time to finance the expenditure[5].

Since under choice B, the $19.05 million borrowed today would itself accrue interest of $0.95 million (= $19.05 x 5%, recall that we assume that public debt pays interest of 5%) the opportunity cost or public sector financing cost of $0.95 million is reflected in the discount rate used in the discounting technique. By borrowing an equivalent smaller amount (i.e. discounted) earlier ($19.05 million today vs. $20 million in a year), the public sector incurs a financing cost reflected in the discount rate (equal to the public sector financing rate). Thus no separate public sector financing cost line item appears in the discounted PSC model for a BFM or DBFM VFM analysis (i.e. there would be no financing box on the PSC side in the sample VFM figure, when drawn for a BFM or DBFM project). It should be noted that if it were assumed that project-specific debt were to be raised by the public sector to finance a traditionally-delivered project, then the financing costs associated with that specific debt would be calculated and would appear as a separate line item in the PSC model. However, the net present value of total project costs would be identical unless the project specific debt was issued at a rate different from the public sector financing rate.

AFP Financing:

Under the AFP model, the private sector is not paid by the public sector until the project is complete and thus in the interim, the private sector has to raise financing in the private markets to meet project expenditures. At the initial VFM stage, IO often engages independent, external financial advisors who provide assumptions on the financing costs and fees that a private party is likely to be charged (and will pass through to the public sector as a cost) by the private markets for undertaking the AFP project being analyzed. In addition IO studies the financing costs and fees observed in the bids received on earlier projects to develop private financing assumptions. Financing costs are modeled through the development of detailed financial models based on the construction (and lifecycle and operating cash flow schedules in a BFM or DBFM) as developed by the relevant external cost consultant. When VFM is reassessed (stage #2), the actual private financing cost in the preferred bid is used to replace the estimated private financing costs in the AFP model.

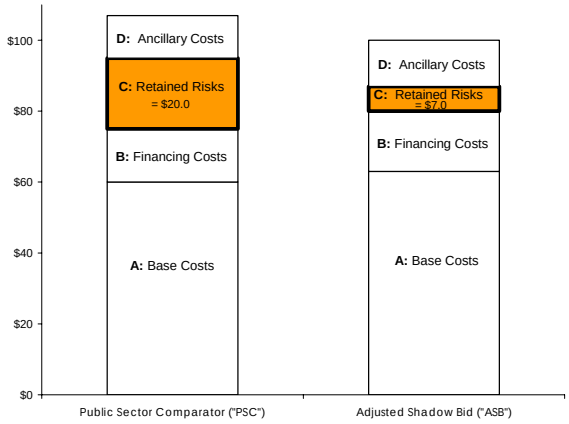
Total financing costs under AFP are typically higher than public sector financing costs because the private sector borrows at a higher rate than the Province. This is a common criticism of the AFP model, but it is important to consider the overall VFM analysis when evaluating which is the appropriate procurement model of choice. Higher financing costs are offset by the risk transfer to the private sector and mitigation of public sector risks under AFP.

[4] The technique of discounting and why the public sector borrowing rate is the appropriate discount rate are further elaborated in a later section.

[5] Thus, today's $19.05 million is the present value of the $20 million a year from now. Stated differently, the borrowing (expenditure) of $20 million in a year's time is equivalent to a borrowing (expenditure) of $19.05 million today (in the regime of a 5% interest rate and 5% discounting rate).

C. RETAINED RISKS

Figure #4



A comprehensive and accurate VFM assessment requires the capture of all costs relating to a project. Even though the raw cost elements of a project are estimated to be a certain amount (by the external cost consultants), it is likely that additional costs will be incurred due to certain events (i.e. risks) that will transpire over the life of a large, complex project. Omissions in the original design and changes that are required after construction has started, for example owing to updated building code regulations, are some of the events that occur and add real costs (as shown in figure #4 above) to projects over and above the projected base costs. Most risks can – if proper time and attention are devoted to the task – be identified and the range of potential costs quantified with a fair degree of accuracy. Industry experts can quantify both the probability of these events occurring and the range of the added costs as a result of these events occurring, based on experience and supporting historical data. A comprehensive review (termed "risk analysis") of these types of risks and the resulting additional costs needs to be factored into the VFM analysis in advance of the project.

In order to accurately estimate and compare the total cost to the public sector of delivering a project through traditional procurement versus AFP, it is necessary to identity and calculate the monetary value of the risks that the public sector will retain under either delivery model.

A comprehensive risk assessment not only allows for a more accurate value for money analysis, but also assists IO and the public sector sponsors in ensuring that the party best able to manage, mitigate and/or eliminate the project risks is allocated the risks under the project agreement.

<u>The risk workshop and risk matrix</u>

There are a large number of risks associated with delivering the types of projects assigned to IO. These risks can be grouped into three broad categories:

1. Retained risks: risks that are retained exclusively by the public sector;
2. Transferred risks: risks that are entirely transferred to the building consortia; and
3. Shared risks: risks that are shared (and retained) to varying degrees between the public sector and the building consortia.

For every project, risks are assessed, categorized, and estimated through a risk workshop. Participants in the risk workshops may include Infrastructure Ontario staff, public sector project sponsors, and external experts (including VFM advisors, various construction and facilities maintenance cost consultants and financial advisors). The risk matrix is a comprehensive chart used by the participants to identify risks and quantify their impact on the public sector under the different delivery models.

The development of a risk matrix consists of the following steps:

STEP #1: Identify the project risks
STEP #2: Allocate the risks
STEP #3: Estimate probability of risk occurrence and resulting cost impact ranges
STEP #4: Run statistical analysis to quantify total risks retained by the public sector

STEP #1: IDENTIFYING THE PROJECT RISKS

The first thing that risk workshop participants do is identify the individual risks that are inherent in the project and group them by category. Generally, these are:

- Planning/strategic;
- Financial/accountability;
- Design and construction;
- Maintenance; and
- Life cycle.

STEP #2: ALLOCATING THE RISKS

Once the major risks have been identified, the workshop participants allocate each of the risks either to the public sector, or to the private sector or as a risk shared by both public sector and private sector, depending on the nature of the specific risk in question, as well as the delivery approach and related project agreement terms.

The following table shows how a risk is allocated to the appropriate stakeholder depending on the procurement model. The risk "Design Coordination and Completeness" is one of several key risks that are transferred to the private sector under AFP (as indicated by the X's).

	Allocation					
	Traditional			*AFP*		
RISK	**Pub.**	**Pvt.**	**Shrd.**	**Pub.**	**Pvt.**	**Shrd.**
Design Coordination Completeness	X				X	

STEP#3: ESTIMATING PROBABILITY OF RISK OCCURRENCE AND RESULTING COST IMPACT RANGES

The next step will determine the probability under each delivery model that a risk will occur causing additional costs (over and above base costs) to be incurred. For example, if one out of every two projects incurs costs due to a particular risk, the probability of occurrence would be 50%.

Once the probability of each risk occurring has been determined, a range of potential costs is then estimated for each risk that is retained[6] by the public sector under either delivery method. The range is expressed as a percentage of base costs with a range from (i) unlikely, but low additional cost (10th percentile); through (ii) most likely additional cost; to (iii) unlikely, but high additional cost (90th percentile).

For example, participants would be asked to estimate what the risks are associated with the risk "Design Coordination and Completeness." Since this is a risk that is retained by the public sector only under the traditional delivery model, the range of potential cost impacts to the public sector is estimated only under the Traditional delivery model. The resulting impact estimates may be as follows:

	Traditional			
	Probability of Risk Occurring	Impact Range		
Risk		**10th**	**Most Likely**	**90th**
Design Coordination Completeness	90%	1.0%	3.0%	8.0%

The table illustrates that if the public sector sponsors were to proceed with the project using the Traditional delivery method, there is a 90% chance that costs for the public sector would exceed the base project costs on account of design coordination and completeness issues, and that the

[6] The public sector may retain risks in full or in part (shared with the private party)

range of cost impact is from 1.0% of base costs at the low end to 8.0% at the high end. Under AFP, this risk is not retained by the public sector and so its monetary impact to the public sector under AFP is zero. If this risk was retained by the public sector under AFP, estimates of the impact of this risk to the public sector would be developed as well.

STEP #4: QUANTIFYING TOTAL RISKS

Once the probability and impact ranges have been established for each risk, the cost of each potential impact can be calculated. The formulas for calculating the cost of a particular risk are:

Cost of Risk$_{PSC}$ =
Base Costs x Probability of Occurrence of the Risk under Traditional delivery x Impact of the Risk under Traditional delivery

Cost of Risk$_{AFP}$ =
Base Costs x Probability of Occurrence of the Risk under AFP x Impact of the Risk under AFP

Since, on any project, the actual impact of any individual risk may fall somewhere along a continuum of impacts that includes the low, most likely and high ranges, and since this will not necessarily be the same for each risk, statistical analysis[7] is required to calculate the average total cost impact of risks retained by the public sector under either delivery model.

Standardization and benchmarks

It is important to note that, while project specific risk estimations are developed and provided by industry experts who have significant relevant experience and knowledge, IO continues to work to minimize subjectivity to the greatest extent possible. One of the ways to reduce this is by using benchmark probabilities and impact ranges that are grounded in historical data and developed by industry experts. AFP project agreements are highly standardized, and as such, the variation in risk ranges should be minimal across projects.

[7] Please refer to a later section for details on this statistical analysis

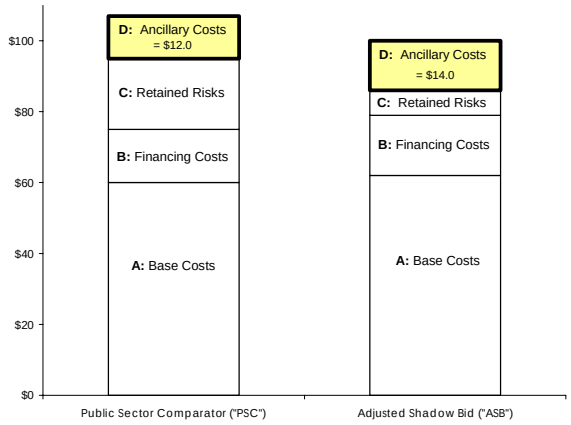
However, every project has its own unique characteristics, and therefore every risk workshop will yield slightly different results. Benchmarks are developed by experts in the relevant field of cost estimation: construction, building maintenance and building lifecycle, and are used as a starting point for risk workshops. Risk ranges are then modified to reflect project-specific risks.

Unquantifiable risks

While considerable time and effort are allocated to quantifying risks in order to more accurately compare the two delivery methods, the VFM analysis should also recognize those risks that are more difficult to quantify. For example, the benefits of having a project delivered on time cannot always be accurately quantified. It would be difficult to put a dollar value on ensuring that the people of Ontario get access to reduced wait times in a new health facility. These are important qualitative benefits that, while not quantified in the VFM analysis, are important to consider nonetheless.

D. ANCILLARY COSTS

Figure #5



There are significant costs associated with the planning and delivery of a large complex project that could vary depending on the project delivery method. For example, there are costs related to each of the following:

- Project management: internal and/or external project management fees, whether direct or indirect, including the incremental costs of Infrastructure Ontario providing its services under alternative financing and procurement.

- Transaction costs: additional transaction costs are typically incurred under alternative procurement and financing, including legal, capital markets, fairness, transaction, architectural and engineering advisory fees.

Ancillary costs are quantified and added to each model as applicable. Project management and transaction costs are likely to be higher under AFP given the greater degree of up-front due diligence. As illustrated in figure #5, ancillary costs are higher, at $14 million, under ASB while they are $12 million in the PSC.

Bringing it all Together to Calculate Value for Money

Once all the cost components and adjustments are determined, the total costs associated with each delivery model can be calculated, and expressed at the same point in time, as the ASB and the PSC. Separate cash flow models are prepared for the ASB and the PSC, reflecting the different cost components allocated to each model and when they will be incurred.

The PSC model would include the base costs, notional public financing costs (in a BF), risks retained under traditional delivery, competitive neutrality adjustment (where applicable), and ancillary costs. The ASB model would typically include base costs (along with the private sector premium), financing costs, risks retained by public sector under alternative financing and procurement, and ancillary costs.

Once the adjusted shadow bid and the public sector comparator are calculated, the positive difference between the PSC and ASB represents the estimated value for money proposition of using AFP. Since the risk components in the models are expressed as a statistical mean, the VFM proposition can also be expressed as a statistical mean of a range of savings.

More on Notional Public Sector Financing Rate and Discounting

The cash flow streams differ between the PSC (e.g. progress payments through construction) and the ASB (e.g. lump sum payment at substantial completion or through post-construction payments during the maintenance period). In order to numerically compare the cash flow streams, the respective cash flows must be expressed in dollars as at a single date in time, known as the base date, by the technique of discounting cash flows.

Bringing cash flows forward in time (future valuing) or back in time (present valuing) is known as discounting and follows the concept of time value of money – the premise that a dollar today is worth more than a dollar in the future. This reflects the opportunity cost of capital: funds available earlier can earn a return, or be used for other capital expenditures and therefore reduce the associated cost of borrowing.

Discounting hinges on the rate used to estimate the value of a future dollar in today's terms. Since the project costs are in future dollars, and are estimated costs that may turn out to be different (e.g. higher) than projected, the discount rate chosen should match the uncertainty inherent in these cash flows. Since higher risks require higher returns, one could argue for a higher discount rate (i.e. risk-free rate plus risk premium) to capture the uncertainty in the project costs. However, this leads to the counterintuitive result of future uncertain costs being heavily discounted leading to a project appearing less costly in present-day dollars as a result of this increased risk. An appropriate method to avoid this result is to quantify the embedded uncertainty in costs through a comprehensive risk assessment. The quantified risks (i.e. cost of risk) can be added to the estimated project costs resulting in virtually "risk-free" costs. This "risk-free" cash flow stream can then be discounted back and expressed in dollars as at bid submission date at a "risk-free" rate. As the public sector financing rate reflects the virtually unlimited taxing power of the crown to repay its debts, crown borrowings are viewed as being risk-free.

Since crown borrowings are viewed as risk-free, the appropriate rate to use for discounting project costs is the public sector financing rate.

Infrastructure Ontario has chosen to be ***conservative*** and ***transparent*** by accounting for risks exclusively through risk quantification workshops, rather than adding a risk premium to the discount rate.

The public sector financing rate simply reflects the Province's most current weighted average cost of capital (WACC). In consultations with the Ontario Financing Authority (OFA), IO has determined that the best proxy for the Province's most current WACC is the simple average of the long-term Provincial debt (bonds with terms of one to 30 years). To neutralize the effects of daily fluctuations on the discount rate, a ten-day rolling average of this simple bond yield average is used as the standard discount rate.

The advantages of computing the discount rate this way can be summarized by the following:

- Readily available, as market rates are public and easily accessible when required;
- Reflects the market cost of funds as opposed to static historical costs; and
- Recognizes the OFA's general borrowing practices rather than being purely based on every project's duration.

The choice of the discount rate has a significant impact on results. Generally speaking, the higher the discount rate, the higher the calculated VFM. IO's choice of the lowest reasonable risk-free discount rate ensures a conservative estimate of VFM.

More on Risk Quantification and Statistical Simulation

Once the probability and impact ranges have been established for each risk, the cost of risk retained by the public sector under Traditional and AFP delivery are calculated using the following formulas:

Cost of Risk$_{PSC}$ =
(Base Costs x Probability of Occurrence of Risk #1 under Traditional x Impact of Risk #1 under Traditional) + (Base Costs x Probability of Occurrence of Risk #2 under Traditional x Impact of Risk #2 under Traditional) + ...+ (Base Costs x Probability of Occurrence of Risk #N under Traditional x Impact of Risk #N under Traditional); where the risk matrix has N defined risks under Traditional delivery

Cost of Risk$_{AFP}$ =
(Base Costs x Probability of Occurrence of Risk #1 under AFP x Impact of Risk #1 under AFP) + (Base Costs x Probability of Occurrence of Risk #2 under AFP x Impact of Risk #2 under AFP) + ...+ (Base Costs x Probability of Occurrence of Risk #N under AFP x Impact of Risk #N under AFP); where the risk matrix has N defined risks under AFP delivery

On any project, the actual impact of any individual risk may fall somewhere along a continuum of impacts that includes the low, most likely and high ranges (the 10th, Most Likely and 90th percentile impacts quantified in the risk workshop). Since the impact will not necessarily be the same for each risk, without knowing in advance the exact combination of risks that might occur in the project being analysed, there are an infinite number of solutions to the above equations depending on the combination of impacts that are plugged into the equations. A well-established mathematical technique for dealing with such problems is the method of statistical simulation. Statistical simulation follows the following steps:

Step 1: Create a parametric model, y = f(x1, x2, ..., xN). In our problem, y is the cost of risk and the x'es are the risk impacts for each of the N risks.

Step 2: Generate a set of random inputs, xi1, xi2, ..., xiN. This is done by randomly picking a risk impact number for each of the N risks, from within the defined range for that risk[8].

Step 3: Evaluate the model and store the results as yi. In other words, plug the randomly chosen set of impacts for each risk into the two equations above and record the resulting cost of risk number for Traditional and AFP delivery.

Step 4: Repeat steps 2 and 3 for i = 1 to a minimum of 10,000 times.

Step 5: Analyze the results using summary statistics, confidence intervals, etc. The statistical simulation exercise generates a full distribution of cost of risks under Traditional delivery and under AFP, as we now have 10,000 different possible costs of risks each under Traditional and AFP delivery. This distribution can be statistically analyzed for the mean (i.e. average or 50th percentile) cost of risk retained by the public sector under Traditional delivery and under AFP delivery. This mean cost of risk is used in the VFM analysis.

Most risk impact ranges, such as the Design Coordination and Completeness risk discussed in the section on retained risks, are positively (or rightward) skewed[9] so the mode ("Most Likely" outcome) of the distribution is less than the mean (average or 50th percentile) of the distribution. Using the "Most Likely" impact to calculate the cost of the risk would thus understate the true cost of the risk on average.

Optimism Bias:

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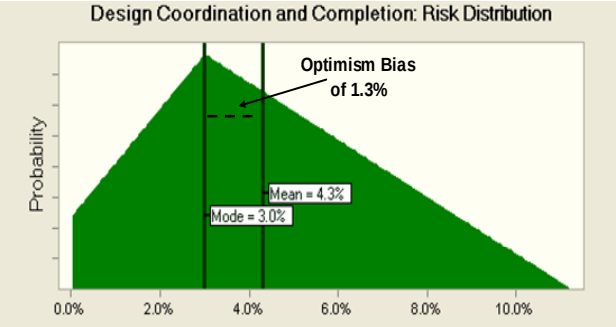
[8] Risks are assumed to be completely uncorrelated and impact ranges are assumed to follow a triangular distribution.

[9] In probability theory and statistics, skewness is a measure of the asymmetry of the probability distribution of a real-valued random variable.

Underestimating the costs associated with project risks is common and is referred to as "optimism bias." In statistical terms, project planners tend to value risks according to their "Most Likely" probability of occurrence, ignoring extreme cases where the incidence of a seemingly remote risk has had a significant impact on a project. For example, if project budgets expanded by exactly 1% over the life of the project eight times out of ten, it would not be unusual to learn that those planning a similar project would budget for only that additional 1%. If the remaining two in every ten projects experienced budget overruns of an extreme 10%, however, the planning and budgeting for a project should take this into consideration (i.e., should recognize that a 1% contingency for budget overruns will not always be sufficient). If the project managers are optimistic and expand the budget by only 1%, two out of every ten projects will experience overruns on average. One should, in fact, expect an average cost expansion of 2.8% (the average of eight projects at 1% and two projects at 10%). IO avoids optimism bias by presenting all risks at their true statistical mean, which takes into account not just the "Most Likely" risk outcome, but also all possible risk outcomes.

The concept of optimism bias can be further illustrated with our example of Design Coordination and Completeness risk. Assume that this was the only risk that appeared in the risk matrix. While we defined the "Most Likely" impact under the Traditional model at 3.0%, the average or mean for this risk is actually 4.3%, owing to the skewed nature of the distribution[10]. This is shown in the chart below.



If one were to budget only 3.0% for this risk, one would underestimate the mean (or average) risk impact by 1.3% (= 4.3% - 3.0%).

Continuing with our earlier example of Design Coordination and Completion risk, for a project with estimated base costs of $60.0 million, we can calculate the cost estimates for this risk at the mean of the risk impact range.

Calculating the Average (or Mean) Cost of a Risk

Design Coordination and Completion Risk:

Mean Impact (Traditional): 4.3%

Cost for Risk =
Base Costs x Probability of Occurrence x Mean Impact

Estimated Mean (Traditional):
= $60.00 x 90% x 4.3% = $2.32 million

Under AFP, this risk is not retained by the public sector so the impact to the public sector is $0 million. This example illustrates a cost savings under AFP for this risk of $2.32 million.

The above example works only because of the assumption that a single risk existed on the project. It was used only to illustrate optimism bias. Since a plethora of risks occur in concert on projects, it is necessary to use a statistical simulation method to establish the true mean impact of the combined risks.

[10] Commercial Statistical programs are readily available that allow a user to select an appropriate impact range distribution (for example a triangular distribution as shown in the example) to calibrate to the 10th, Typical and 90th percentile impacts as established in the risk workshops in order to generate the Mean of the defined distribution.

Final Comments

The methodology as set out in this document applies to building projects assigned to IO by the Province. The VFM analysis is prepared at multiple stages of procurement by an external advisory firm. The VFM analysis serves as a decision tool for the IO Board of Directors at multiple stages of procurement ensuring that the choice of proceeding via AFP is the best value proposition for the public sector at a given point in time based on best information available.

IO's methodology and approach to VFM may be subject to change as new and better information becomes available, but the ultimate methodology and all underlying assumptions will be based on what is the most conservative, accurate and transparent approach to estimating VFM. This ensures that public interest remains paramount.

For additional information and greater understanding of IO practices, this document should also be read in conjunction with any other IO documents on VFM, such as VFM reports on individual projects.

Glossary

Adjusted shadow bid: The shadow bid of a particular project adjusted for risks retained by the public sector under AFP and for ancillary costs.

Alternative Financing and Procurement (AFP): A range of infrastructure project delivery methods which use private expertise and financing to strategically rebuild vital infrastructure, on time and on budget, while ensuring appropriate public control and ownership.

Ancillary costs: The soft costs of delivering a project. These costs normally include: project management, legal services, architectural and engineering, advisory and other professional fees, transaction, capital markets and fairness advisors.

Build Finance (BF): Typically considered for smaller projects that involve renovations or significant interconnections to existing infrastructure (e.g., shared HVAC, build-out of existing floors). The private sector is generally responsible for construction and financing during the construction period and the project is paid for by the public sector at the completion of construction.

Build Finance Maintain (BFM): An AFP model in which the private sector is generally responsible for construction, maintenance and long-term financing. The project is paid for in instalments over a fixed period, usually 25 to 30 years. The public sector sponsor is responsible for developing the detailed design of the facility.

Competitive neutrality: An adjustment made to remove certain perceived additional costs of delivering a project using AFP. In certain instances, the base costs under AFP delivery will include a provision for certain taxes and insurance premiums. The equivalent costs will not appear under the PSC as the public sector may be exempt from paying certain taxes and may "self insure." The adjustment consists of adding such costs to the PSC.

Construction costs: Costs incurred in completing the construction of a project, including labour, materials, construction equipment, site preparation, construction management, typical contingencies, etc.

Design Build Finance (DBF): A delivery model in which the private sector is generally responsible for the design, construction and financing during the construction period. The project is paid for by the public sector at the completion of construction.

Design Build Finance Maintain (DBFM): Typically considered for large projects involving new construction on a vacant site (greenfield or brownfield). The private sector is generally responsible for design, construction, long-term financing and maintenance. The project is paid for in instalments over a fixed period, usually 25 to 30 years.

Discount rate: The interest rate at which future cash payments are discounted to a base date to determine their value at the base date. Discounting is the process which allows costs to be assessed in current-value dollars.

Facility management: This typically includes the provision of management, maintenance and repair services related to the building and building components to allow the facility to be used for its intended purposes throughout the term of the Project Agreement, in addition to soft facilities management such as grounds maintenance, parking, security, retail services like a food court or cafeteria, and dispatch services (e.g. "one-call" help desk).

Lifecycle costs: Costs typically associated with planned or scheduled replacement, refreshment and/or refurbishment of building systems, equipment and fixtures that have reached the end of their useful service life during the project term.

Notional public sector financing cost: An estimate of the notional financing costs that the public sector would incur when a project is to be delivered using a Traditional delivery method.

Optimism bias: A tendency of those planning infrastructure projects to fail to take into account the full magnitude of risks retained by the project sponsor.

Private sector financing costs: The financing costs incurred by bidders (and ultimately passed on to the public sector) under a project delivered through alternative financing and procurement.

Private sector risk premium: The premium (exclusive of the private sector financing rate) charged by bidders to compensate for the risks transferred to them under AFP in connection with the goods or services being procured.

Project risks: Risks are events that can lead to serious cost increases, construction delays, or both should they occur. Risks can be quantifiable (e.g. construction cost overruns) or qualitative (e.g. social, political or economic risks associated with the delayed delivery of a project).

Public sector comparator (PSC): Estimated total costs (including adjustments for risks retained and ancillary costs) to the public sector of delivering an infrastructure project using Traditional procurement processes.

Risk matrix: A detailed table or chart that lists the conceivable quantifiable risks for each project. These risks range from cost overrun and design risks to planning and regulatory risks. Each risk is described in detail along with the probability of the risk occurring and a range of probable cost impacts as a result of the risk occurring.

Risks retained under traditional delivery: The project risks which are borne by the public sector when a project is delivered using a Traditional delivery method.

Risks retained under alternative financing and procurement delivery: Any project risk retained by the public sector when a project is delivered using alternative financing and procurement.

Shadow bid: An estimate of the expected private-party bid (including financing costs) for a particular AFP project.

Traditional delivery: Procurement of a project using a Stipulated Sum Contract (usually the CCDC2 form of contract) for construction and, if applicable, a series of short-term maintenance contracts post-construction.

Value for money: The difference between the Public Sector Comparator and the Adjusted Shadow Bid is referred to as the Value for Money. There is said to be positive Value for Money by procuring a project using AFP when the Adjusted Shadow Bid is less than the Public Sector Comparator.

Appendix: Deloitte Letter

Deloitte.

Deloitte & Touche LLP
79 Wellington Street West
Suite 1900, PO Box 29 TD Centre
Toronto, ON M5K 1B9

Tel: (416) 601-6150
Fax: (416) 601-6690

February 22, 2007

Infrastructure Ontario
777 Bay Street, Suite 900
Toronto, Ontario M5G 2C8

Attention: Anurag Gupta
Sr. Manager, Project Finance

Dear Sir

ASSESSING VALUE FOR MONEY: A GUIDE TO INFRASTRUCTURE ONTARIO'S METHODOLOGY

We have been pleased to be associated with the development of your Value for Money methodology. We have reviewed "*Assessing Value for Money: A Guide to Infrastructure Ontario's Methodology*" (the "Guide").

A value for money assessment consists of a comparison of the estimated total costs of delivering a public infrastructure project using alternative finance and procurement as opposed to the traditional public sector project delivery method.

We confirm that the value for money methodology described in the Guide will, if properly applied using valid assumptions, yield fair and accurate results.

We also confirm that the methodology is consistent with best practices observed in other Canadian and international jurisdictions.

Yours very truly,

Deloitte & Touche LLP

Deloitte & Touche, Canada LLP

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