Pattullo Bridge Replacement Project

Risk Report

January 2018

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

1.1 PURPOSE

The purpose of this report is to document the risk analysis process for the Pattullo Bridge Replacement Project (the Project) at the business case stage. The Project is being delivered by the Province of British Columbia, "the Province". Key areas covered by this report include:

- An overview of Partnerships BC's project risk management approach and guidance from the planning stages through to implementation;
- The methodology by which risks were assessed, quantified, and incorporated into the financial analysis of the business case; and
- The results of the risk analysis conducted.

The process has largely focused on identifying Project risks, allocating them between the Province and the private sector, developing potential risk management strategies and incorporating quantified risks into the financial analysis of the business case.

1.2 SCOPE AND CONTEXT

This report reflects the risk management work that has been completed by the Project Team to date. The process has primarily focused on identifying specific Project risks, allocating those risks between the Province and private partner (also referred to as the Contractor) for the selected procurement models, developing potential risk management strategies and incorporating quantified risks into the financial analysis of the business case. The risk register has been reviewed and updated several times since it was initially created; this report and the risk register reflect the cumulative results of the reviews.

As discussed in Section 3 of the Business Case, the two procurement models analyzed in this report are the Design-Build (DB, also referred to as the Traditional) model and the Design, Build, Finance (DBF, also referred to as the Partnership) model.

1.3 PROJECT BACKGROUND

The Project involves constructing a new bridge to replace the existing Pattullo Bridge which connects the City of Surrey and the City of New Westminster. The new bridge will be located upstream of the existing bridge. It will provide four vehicle travel lanes and two multiuse paths with modern lane widths, better connections and interchanges, a centre barrier, high-quality cycling and pedestrian facilities and will not preclude the potential for a future expansion to six vehicle travel lanes if necessary to accommodate growth in traffic volume. The Project also includes improved connections to the local road network in the

City of Surrey and the City of New Westminster, as well as removal of the existing bridge upon completion of the new bridge.

For a more detailed description of the project background and scope, refer to the *Pattullo Bridge Replacement Project Business Case*.

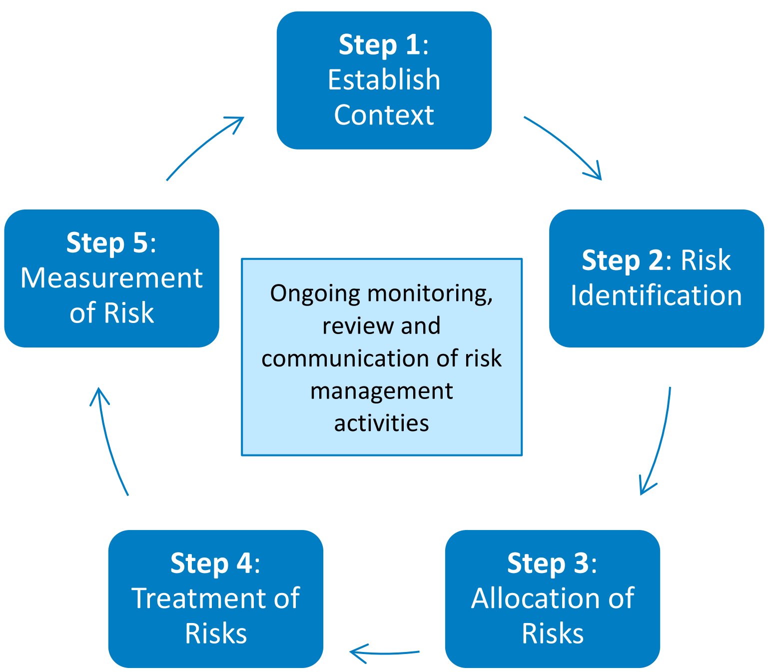
2 RISK MANAGEMENT METHODOLOGY

2.1 PARTNERSHIPS BC GUIDANCE

Project risk is defined as the chance of an event or condition happening which could cause the actual project circumstances to differ from those assumed when forecasting project outcomes or objectives. Risk is an inherent part of any project, and to ensure a successful project outcome, risk must be effectively managed. Depending on the amount of information available, risk can be measured qualitatively and, in some instances, quantitatively.

Risk management includes the actions or planned actions that impact the probability and consequences of a risk event in order to ensure that the level of risk assumed falls within an acceptable limit for the Project Team. Every project must consider and manage risk in order to be successful. A project's risk exposure is fluid and adjustments will need to be made as the project moves through its various stages. Careful risk management allows the Project Team to anticipate key vulnerabilities and develop proactive strategies to deal with them. The following figure provides an overview of the risk management process.

Figure 1: Risk Management Overview



Risk management in the context of large capital infrastructure projects does not simply involve transferring all project-related risks to the private sector. The goal of an effective contractual arrangement is to allocate project risks to the party best able to manage them at the lowest cost. This can be further enhanced when assigned risks are supported by appropriate incentives and penalties through the use of performance-based contracts. For example, under any procurement model, the Design-Builder is better suited than the Province to manage the physical construction activities so construction risk is transferred to the Design-Builder.

An efficient or optimal allocation of risk between the public and private sector participants will ultimately maximize value for money for taxpayers.

The Government of British Columbia, through Partnerships BC and in conjunction with the Risk Management Branch (RMB) of the Ministry of Finance, has established a guideline with respect to risk management for large capital infrastructure projects through the stages of planning, procurement and implementation. Notwithstanding differences in terminology, the Province's guideline is generally consistent with the principles, framework and process described in the ISO 31000:2009 Risk Management Principles and Guidelines.

A failure to fully take account of risk is one of the key factors when public projects are not delivered on time, on budget or to specification. Partnerships BC's guidance on risk management takes a systematic approach to risk, estimating the range of potential impacts of risk on a risk-by-risk basis through the project's planning, procurement, design, construction and operating phases.

This systematic approach to risk considers:

- An extensive risk matrix to ensure a comprehensive assessment;
- The range of possible outcomes or consequences;
- The risks associated with capital, operating and life cycle costs; and
- Specific characteristics of unique risks.

Partnerships BC uses a standardized risk matrix (also referred to as a risk register) template as a tool to consolidate risk information (refer to Section 2.2.4 for additional information about the risk matrix).

Risk analysis is dynamic and should be revisited throughout the life of a project. The Project Team should plan regular updates to the risk matrix as part of ongoing risk management efforts. As a project moves through the planning phase and into procurement, and more information emerges, new risks not previously recognized will be identified (especially through development of the legal documents or "Contract"[1] and associated payment mechanism). These risks should be added to the risk matrix,

[1] The term Contract in this context refers to either a stipulated sum contract in the case of a DB or a project agreement in the case of a DBF.

allocated appropriately and quantified where possible. Similarly, some risks previously identified may no longer exist and should be reassessed.

During negotiations and financial close, the main subject for negotiations becomes the Contract. The risk matrix allows for the identification and allocation of risks at a high level, but the detailed risk allocation will be reflected in the Contract wording.

2.2 RISK ASSESSMENT

Risk assessment is the overall process of risk identification, risk analysis and risk evaluation. It allows the Project Team to better understand how risk can affect achievement of the project objectives and ensure that effective treatment strategies and project controls are developed.

During the business case phase of the project, risk assessment can be broken down into the following steps:

(a) Identifying and clearly describing the major potential risk events for a project;

(b) Analyzing the range of possible consequences of the risks identified;

(c) Evaluating the likelihood and potential impact of those consequences;

(d) Developing prevention and mitigation strategies for identified risks;

(e) Quantifying, where possible, the dollar value of these outcomes to the project; and

(f) Recording the results of this process in a risk matrix.

2.2.1 Risk Identification and Description

The first step in the risk assessment process involves identifying and describing the potential material risks (from both technical and financial perspectives), the causes and potential consequences. The aim of this step is to generate a comprehensive list of risks based on those events that might create, enhance, prevent, degrade, accelerate or delay the achievement of project objectives.

For ease of tracking, risks are organized by the stage of the project life cycle in which they are expected to occur. There are generally two key periods in a project's development:

- Planning, procurement, design and construction and transition/commissioning of the project leading up to service commencement (herein referred to as Capital Risks); and
- Operating period risks (herein referred to as Operating Risks) are identified, allocated and evaluated but not quantified for financial modelling and value for money purposes since the procurement method compares a DB and a DBF.

During preparation of the business case, the project is in the planning stage. Technical and financial information about the project is gathered, analyzed and compiled into a comprehensive document that becomes the business case. The information is subject to due diligence at this stage, however there can be further refinement and modification throughout the project's life cycle. It is important at this stage to specify sufficient detail about each risk event, as a comprehensive description can help inform the risk quantification and the development of potential scenarios.

When preparing documentation in anticipation of the procurement stage, the risk matrix can be used to guide or confirm the risk allocation contained in the project's Contract.

2.2.2 Risk Allocation

Once the risks have been identified, each one is evaluated to determine which party (the Province or the private sector) is exposed under each procurement model and which party is best able to manage the risk at the lowest cost. From the perspective of the Province, a risk can be transferred to the private sector, shared with the private sector or retained. One of the key differences between procurement models is how risk is allocated between the parties and subsequently managed by the responsible party.

As the project progresses during the procurement process, it may become apparent that the initial allocation does not provide the best value for money for the Province, in which case the allocation may be amended as appropriate. For example, a geotechnical risk may initially be classified as transferred during the business case stage. Further geotechnical studies completed after the business case may reveal unexpected ground conditions. Rather than fully transfer the risk, it may be more cost-efficient at that point to share the risk exposure with the proponents. This example illustrates the importance of keeping a risk management plan up to date throughout a project's development.

The transferred risks, together with the portion of the shared risks expected to be transferred to the private sector, are incorporated into the draft Contract. Until negotiations with the preferred proponent begin, it is assumed that each shared risk will be "split" equally between the private sector and the Province. This assumed split is further refined during the procurement stage of the process as the contract is developed and comments are received from proponents during the Request for Proposals (RFP) stage.

The retained risks are expected to be retained by the Province and are used in part to assess the size of the project reserve necessary to protect against the risk exposure.

Project Teams will typically not quantify risks that may be high impact, but have a very small probability of occurring. These include natural disasters and other "high impact, very low probability" events. Typically speaking, broader provincial emergency plans (which are beyond the scope of this analysis) would come into play under such circumstances.

2.2.3 Risk Treatment: Prevention and Mitigation

The risk allocation described above is part of an ongoing risk management process that enables parties to reduce the probability of a risk occurring as well as mitigating the consequences of a risk should it occur. A primary objective of risk management is to reduce potential negative outcomes by identifying risks, analyzing them and implementing strategies to deal with them on an ongoing basis.

While risks are often thought of as events with only negative consequences, proactive risk management can create value. For example, a comprehensive investigative testing program carried out in advance of procurement may provide the Project Team with more complete information and less uncertainty. New information may reduce the probability of a risk materializing or may provide the Project Team with an opportunity to proactively deal with the issue at a lower cost.

The treatment strategies developed should be clear and realistic and involve the necessary Project Team resources. The risk management process should form an integral part of the Project Team's broader project management.

2.2.4 Risk Matrix

A risk matrix is the key document produced in the risk management process. Developed through a series of risk workshops, it consolidates and provides a record of the following information:

- The identification and description of all relevant risks;
- Risk allocation between the Province and the private sector;
- Identification of high level prevention and mitigation strategies; and
- Where possible, quantification of the risks based on the best available information at the time.

Attachment 1 illustrates how the risk matrix is organized and describes the information captured in the various columns. The risk matrix is a living document that informs the risk management strategies developed by the Project Team. It should serve as a key project management tool and be updated at key project milestones (e.g. before the release of the procurement documents, just after contract execution, regularly during design and construction, etc.).

2.3 RISK QUANTIFICATION

A comprehensive quantitative evaluation of risk presents a range of likely cost outcomes and provides a reliable means of testing value for money between procurement models. It also encourages bidding competition during procurement by creating confidence in the financial rigor of the Province's risk-adjusted project cost estimate that was used to set the affordability ceiling to which proponents must bid.

Risk quantification occurs once the risk identification, description, allocation and categorization activities have been completed to a sufficient degree. Selected risks are quantified to ensure sufficient money in the all-in project budget to successfully deliver the project. The risk adjustment included in the project budget must account for both transferred risks (which the Design-Builder will include in its bid) and retained risks (which will form part of the Province's project reserve).

If a risk is transferred, it is quantified from the perspective of the Design-Builder and what the Project Team estimates would be included in a reasonable and competitive financial proposal. If a risk is retained, it is quantified from the perspective of the Province and the cost impact the risk would have on the project.

Risk quantification can be a time consuming exercise and should focus on the most material risks to the project. Typically, only 10 – 20 of the potentially hundreds of risks are quantified. In some cases a single quantified risk can capture the potential impact of multiple risks. While risks are quantified individually, the total quantified risk values should be viewed from a portfolio perspective. It is expected that some risks will come to pass, some will not and, of those that do occur, the impact may be greater or lower than expected. The expectation is that, by quantifying the key material risks, the Project Team will have a sufficient reserve in place to adequately address risk events within the Project budget. The impact of individual risks on the total capital risk value is illustrated and described in section 3.3.1.

Project Teams consider several factors in determining which risks to quantify. These may include:

- Materiality – If the risk were to materialize, would it have a significant impact (financial, schedule, public perception, program delivery)?
- Estimable – Can the risk impact be reasonably and accurately estimated?
- Risk Ranking – How high is the risk ranking (low/medium/high/extreme)?

The decision on which risks to quantify involves examining past precedent projects, as well as considering unique project-specific risks that warrant further attention.

Most risks are quantified using a triangular distribution which involves inputting three key variables: low/best case (5th percentile), most likely (50th percentile), and high/worst case (95th percentile). Using a triangular distribution is often regarded as a good proxy for a normal distribution but is much more straightforward in terms of obtaining the appropriate inputs. Refer to section 2.3.2 for additional information.

2.3.1 Risk Quantification and the Project Contingency

The contingency is a critically important item in the project budget and should not be removed and replaced with the quantified risk amount.

In traditional cost estimating, large contingencies are often added to the expected cost, reflecting the fact that unforeseen circumstances may arise that could result in additional costs or delays. These contingencies represent an initial estimate, based on the cost estimator's experience, of the expected additional costs that may be attributed to risks usually associated with changes or unanticipated events.

Contingencies are not dealt with consistently across all Quantity Surveyor (QS) estimates. The QS examines how developed the project planning is and bases the contingency on previous experience. When the QS creates the contingency for the Project's indicative design estimate, the QS assumes the contingency will be spent, which means the contingency cannot be regarded as a substitute for risk costing. The Project Team should review the contingency with the QS to confirm costs are not being double counted.

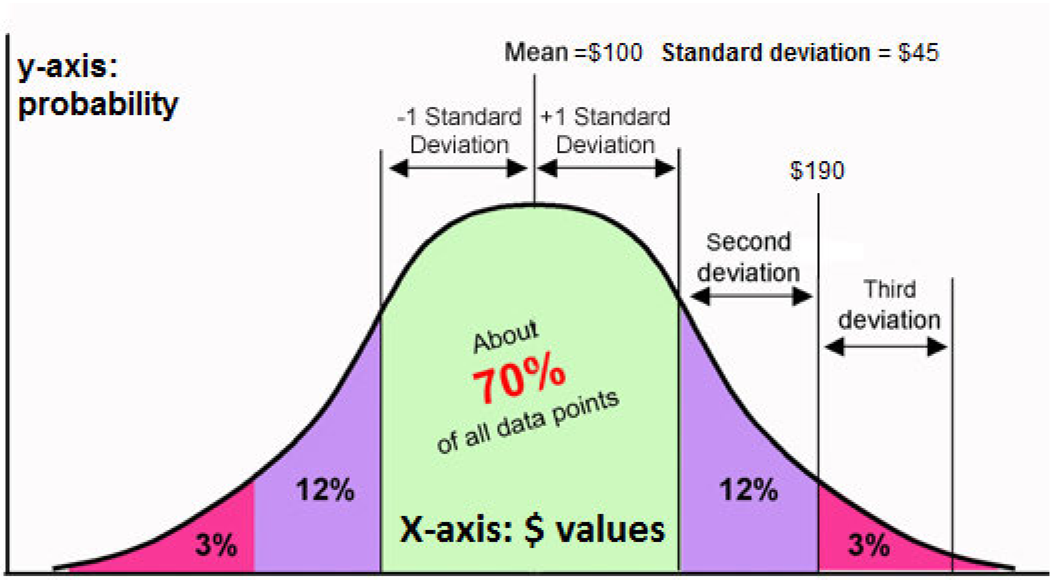
2.3.2 Monte Carlo Analysis and Risk Distributions

The expected value of each quantified risk is calculated based on the assumed distribution and the estimated probabilities and scenario outcomes for each risk. In order to quantify the overall risks and develop aggregated distributions, Partnerships BC uses statistical software, called @Risk, to perform a Monte Carlo analysis[2]. Monte Carlo analysis provides a means of evaluating the effect of uncertainty using a large number of scenarios. It is a tool used to estimate the total variation of project risk resulting from the individual quantified risks. The Monte Carlo analysis takes the assumptions for each risk, aggregates them, and then runs thousands of simulations to produce a distribution of the total value of quantified risks.

The Monte Carlo analysis produces distributions that often approximate a normal distribution curve, also known as a bell curve, as illustrated in the figure below.

[2] Monte Carlo analysis involves a series of computational algorithms that rely on repeated random sampling to compute their results.

Figure 2: Example Normal Distribution Curve



To help understand the distribution, the mean of $100 refers to the average data point and the standard deviation of $45 refers to the amount of variability. Generally most risks are expected to fall close to the mean as illustrated by the green section. Approximately 70 per cent of the risk outcomes are expected to fall between $55 and $145. If one refers to the three per cent indicated by the pink area on the far right (also referred to as the 97th percentile), one can say that there is an estimated 97 per cent chance that the risk values will be at or below $190. This is equivalent to saying there is an estimated three per cent chance that the risk values will exceed $190.

When developing the project budget, the percentile point that is selected on the risk distribution curve will depend on the level and quality of information available and the Project Team's level of risk aversion. This is discussed further in section 3.2.1.

3 PROJECT RISK PROCESS

3.1 RISK WORKSHOPS

The first step in the Project's risk management process was to identify the risks. Multiple risk workshops, facilitated by Partnerships BC and KPMG, were held in November and December 2015, in April and July 2017 and in January 2018. Risks were separated into two broad categories:

- Capital Risks – planning, approval, procurement, design and construction; and
- Operating Risks – operations, maintenance and life cycle.

Financial and commercial risks were captured either in the Capital or Operating Risks as appropriate.

A variety of professionals from the private and public sectors participated in the risk identification and quantification exercise. These participants are subject matter experts in one or more of the following areas: procurement, engineering, cost estimating, design and construction, project management, finance, commercial and operations and maintenance.

Participants included representatives from: Partnerships BC, TransLink, the Province and consultants retained by the Project Team including the Owner's Engineer, Technical Advisor, Business Advisor, Cost Estimator and others. A brief biography for each participant can be found in Attachment 3.

The Project's Cost Estimator reviewed the quantified risks to ensure that risks being quantified were not already included in the Project's contingency estimates. The DB and DBF risk values are calculated on the base costs before contingencies. Furthermore, DB and DBF risk estimates assume that prudent and reasonable mitigation, before and after risk events, has been or will be completed.

During the workshops, participants reviewed a pre-populated list of Project risks and updated it as appropriate for the Project. Attachment 2 of this report contains the Project's complete risk matrix.

After the initial risk assessment, various Project Team members were assigned certain risks to quantify so as to assess the initial cost implications to the Project under both procurement models in the event the risks materialize.

Once the Project Team provided its initial estimates for the quantified risks, Partnerships BC reviewed the estimates and provided feedback to ensure the estimates were properly documented with sufficient justification, and that the assumptions were reasonable and consistent with the Project scope and risk description. This feedback resulted in further adjustments to the initial assumptions. The risks were then further reviewed through a series of due diligence meetings, which included individuals from the risk workshops. The completed risk quantification results and worksheets are included in Attachment 2.

3.2 RISK RESULTS ANALYSIS

The Project Team quantified a total of . There were no Operating Risks since the value for money analysis of a DBF procurement method does not include a quantified analysis of the operating period. Operating risks were still discussed for determining the amount of withholding required for the warranty period after the construction of the Project. The allocation of the quantified risks are presented later in Table 2.

The Monte Carlo analysis produced simulation results for the Capital Risks for both the DB and DBF models, capturing the total, retained and transferred risk amounts. These results are discussed in sections 3.3.

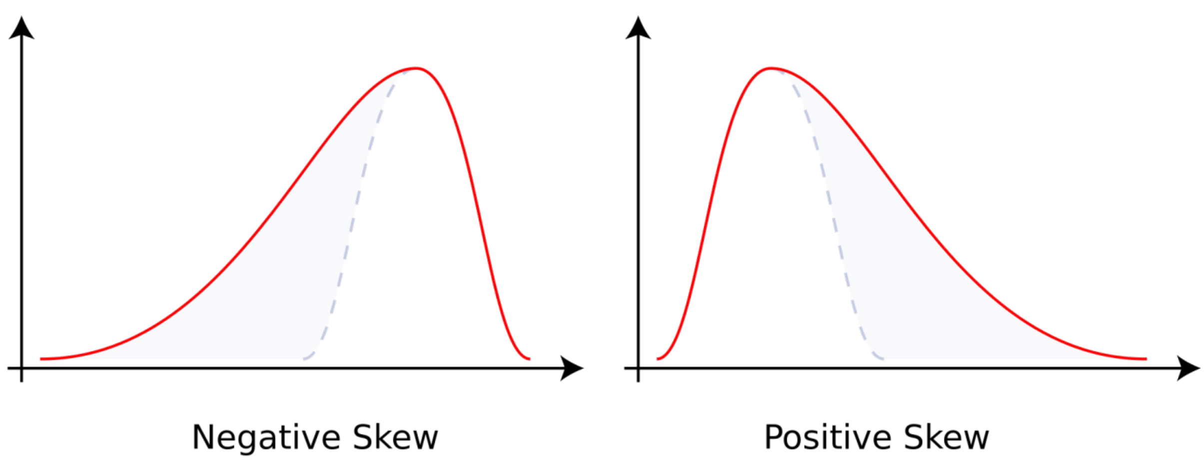
3.2.1 Selected Risk Percentile

The 67th percentile of the risk distributions was selected to reflect a prudent level of risk aversion given the stage of Project planning and the large number of unknowns related to the Project. Selecting the 67th percentile is equivalent to saying that the Project has sufficient risk money included in the budget approximately two of out every three times. As the Project moves forward and is further developed, the quantified risks and the risk percentile can be revisited as more information becomes available and the level of uncertainty decreases.

3.2.2 Skewness Effect

Skewness is a statistic that measures the asymmetry in a distribution. Figure 3 illustrates the effect of negative and positive skew on a normal bell curve. Skewness causes a curve to appear distorted or skewed either to the left or the right and is common in quantified risks.

Figure 3: Skewness Effect



Skewness effect precludes simply adding together the retained and transferred distribution curves to get an accurate total risk value. Care was taken when determining the values of the risks entered into the financial model to account for the skewness effect and ensure the selected values summed to the 67th percentile of the total risk curve and not the 67th percentile of the individual retained and transferred risk curves.

3.2.3 Correlation

Correlation is a measure of the extent of interdependence between two or more variables. A positive correlation means that as one value increases, the other value increases as well. A negative correlation means that as one value increases, the other value decreases. Correlation does not, however, imply causation. While certain quantified risks are likely to be correlated, this risk analysis has not included any correlation assumptions. This is a conservative assumption and tends to understate the aggregate risk value.

3.3 QUANTIFIED CAPITAL RISK RESULTS

Figure 4 overlays the overall Capital Risk distribution (which approximates a normal distribution) for the DB and DBF models. The graph indicates the relative level of risk between the two procurement models, but does not differentiate between the risks held by the Province and those which would be transferred to the Design-Builder. The 67th percentile values were incorporated into the financial model and are summarized in Table 1.

As Figure 4 illustrates, the total capital risk value under a DBF model is while under a DB model, the total capital risk value is expected to be . The figure also illustrates that there is an that capital risks will exceed in the DBF model, whereas in the DB model, the chance of exceeding .

Figure 4: Total Capital Risk Overlay Graph – DB vs DBF Real $000s

Figure 5 below presents an overlay of the retained Capital Risk distribution. It illustrates that there is an the retained risks under the DBF model will compared to a under the DB model.

Figure 5: Total Retained Capital Risk Overlay Graph – DB vs DBF Real $000s

Finally, Figure 6 presents an overlay of the transferred Capital Risk distribution. It illustrates that there is a that the transferred risks under the DBF model will million compared to a under the DB model.

Figure 6: Total Transferred Capital Risk Overlay Graph – DB vs DBF Real $000s

Table 1 summarizes the results of the Monte Carlo analysis for the Capital Risks in real (uninflated) dollars[3].

Table 1: Capital Risk Value Summary (Real $ Millions at 67th percentile)

Capital Risk	DB	DBF
Risks retained by the Province		
Transferred risk added to the construction contract by the Design-Builder		
Total[1]		

[1] Due to the skewness effect described in section 3.2.2, the retained and transferred risk values in this table have been adjusted slightly downward in order to equal the total 67th percentile value of the respective total distribution.

Values may not add up due to rounding.

[3] All references to real dollars (non-inflation adjusted) will be inflated/escalated in the financial model to nominal (as-spent dollars) based on the assumed timing of the risk.

3.3.1 Capital Risk Sensitivity Analysis

Figure 7 illustrates the individual quantified risks that have the most significant impact on the total DB Capital Risks. The most significant risk, , is at the top, with other risks following in descending order of impact. The baseline value at the bottom represents the 67th percentile of the total DB Capital Risk. The top risk can be interpreted as saying that can cause the total Capital Risk value to depending on whether the risk materializes and its impact if it does. The figure illustrates the wide impact that risk can have on a project budget and can inform the decision to allocate Project Team resources to the most material risks. The figure also demonstrates the importance of viewing the quantified risk from a portfolio perspective, recognizing that there is a wide range of potential outcomes for any particular risk.

Figure 7: Tornado Graph: Top 5 DB Capital Risks (at the 67th percentile)

Figure 8 presents the tornado graph for the total DBF Capital Risks. The risk exposure for the DBF differs from the DB as reflected by the different order of risks and different sized bars. The top ranked risk in this case is , which can cause the total DBF Capital Risk exposure to range anywhere from a .

Figure 8: Tornado Graph: Top 5 DBF Capital Risks (at the 67th percentile)

To mitigate the risk of scope changes during procurement, early and ongoing meetings will be hosted with key stakeholders to identify scope terms and to establish an understanding of site conditions and constraints. Municipal agreements will also be negotiated in advance of procurement.

The Project Team is aware of the risk mitigation strategies in the risk matrix and will be actively working to manage the risks to minimize the probability of occurrence and the impact if these risks do materialize.

3.4 UNQUANTIFIED RISKS

In addition to the quantified risks, there are a number of Project risks that have not been quantified or assigned a contingency, but should nonetheless be closely managed by the Project Team as the Project progresses. These include:

The Project Team is aware of the risk mitigation strategies in the risk matrix and will be actively working to manage the risks to minimize the probability of occurrence and the impact if these risks do materialize.

3.5 RISK QUANTIFICATION SUMMARY

The quantified risks and their allocation between the Province and the Design-Builder are summarized in Table 2 for both, the DB and DBF.

Table 2: Project Risk Allocation Summary:

No.	Type of Risk	Allocation of Risk			
		DB		DBF	
		Province	Design-Builder	Province	Design-Builder
Capital Risks					

No.	Type of Risk	Allocation of Risk			
		DB		DBF	
		Province	Design-Builder	Province	Design-Builder

No.	Type of Risk	Allocation of Risk			
		DB		DBF	
		Province	Design-Builder	Province	Design-Builder

Table 3 summarizes the risk quantification amounts included in the financial analysis. As discussed in section 3.2.2, the retained and transferred risk totals were adjusted downward for both models so that the sum equals the 67th percentile of the total risk distributions.

Table 3: Risk Quantification Summary (Real $ Millions at 67th percentile)

Financial Model Risk	DB	DBF
Risks retained by the Province		
Transferred risk added to the construction contract by the Design-Builder		
Total		

In the DB and DBF models, the same Capital Risks are being transferred, but are priced differently by the Design-Builder based on the inclusion of private finance in the DBF model. The DBF model is considered more efficient in transferring the risk and therefore the same risk transfer can be achieved at a lower cost than in the DB model. This efficiency is realized through the inclusion of private finance at risk.

3.5.1 Net Present Cost Analysis

In order to include the risk costs in the financial model, assumptions were made to simplify the development of a risk cash flow profile. Each risk potentially occurs at different times through the Project's life cycle. A net present cost (NPC) approach was used to compare the risks on a consistent basis. The cash flows were discounted at 4.8 per cent to January 1, 2018. This discount rate is consistent with the one used in the rest of the business case. Table 4 presents the NPC of both models' risk totals, separated out by the anticipated allocation.

Table 4: Risk Quantification Summary (NPC $ Millions at 67th percentile, discounted at 4.8% to January 1, 2018)

Financial Model Risk	DB	DBF
Capital Risk		
Risks retained by the Province		
Transferred risk added to the construction contract by the Design-Builder		
Total		

4 NEXT STEPS AND PROJECT / MANAGEMENT RESERVE

As illustrated in the previous section, the DBF is estimated to provide positive VFM over the DB. Under the proposed DBF model, the Project Team should actively track the Project's risk exposure and update the risk matrix at the following key milestones:

- During the affordability cost refresh prior to the release of the RFP. At this stage, the Project Team should create a transferred risk memo that examines whether the transferred risks identified in the risk matrix have been reflected in the proposed draft Contract;
- During the RFP process if there are material risk allocation issues during the collaborative meetings (e.g. geotechnical); and
- Upon reaching financial close in anticipation of the design and construction implementation activities. This would include an update of the transferred risk memo to confirm that the final Contract will in fact transfer the expected risks.

To support the Project Team's effective implementation of risk management strategies and to help the team deal with the consequences of retained risks that materialize, an interest rate reserve should be established. An Interest Rate Risk Reserve is created to protect the Province against exposure to rising interest rates prior to financial close at which point, under a DBF model, the Project's interest rate becomes fixed. The F1 risk worksheet in Attachment 2 describes how this risk value was calculated. This reserve is only in place until financial close.

As part of the capital funding request, it is recommended that the Project Team include the following interest rate reserve amount:

Table 5: Capital Risk Reserve Amount (Real $ Millions at 67th percentile)

Capital Risk	Amount
Interest Rate Risk Reserve	

ATTACHMENT 1: RISK MATRIX SECTION DESCRIPTIONS

The following attachment explains the different sections of the template risk matrix. It is organized into categories, each of which is explained in the figures below.

Figure 9: First Portion of Risk Matrix

Category	ID#	Risk Name	Quantify (Y/N)	Description	Cause	Effect	L	C	Inherent Risk (Risk Rating)

Category: This categorizes the risks into sub-groups for ease of reference.

ID#: This is the number column for tracking the risks. The convention is to group related risks and assign a letter/number combination.

Risk Name: This column captures the assigned name for the risk.

Quantify (Y/N): There are a large number of risks in the matrix, many of which can't be quantified or, if quantified, the cost impact would be immaterial. The two possible letters for this column are "Y" for quantified and "N" for not quantified.

Description: This column is where the detailed description of the risk is inserted. It is important to specify sufficient detail about each risk event to develop appropriate and effective risk management and allocation strategies. A comprehensive description can help inform the risk quantification and the development of potential scenarios and outcomes.

Cause: Events that could cause the risk to materialize.

Effect: Potential impacts if the risk does materialize.

Risk Assessment: The last three columns in Figure 9 are described below in the tables.

Table 6: Likelihood and Severity of Consequence

Column	Description
L	Likelihood of occurrence
C	Severity of consequence
Inherent Risk (Risk Rating)	Inherent risk ranking and is a product of L X C. The possible outcomes are low, medium, high or extreme.

Table 7: Likelihood of Occurrence Description

LIKELIHOOD			
	Descriptor	Approximate Probability (range / single value)	Frequency (for example, in a 30-year context)
5	Almost Certain	.90 - 1.00 [.95]	e.g. Once a year or more
4	Likely	.55 - .89 [.72]	e.g. Once every three years
3	Possible	.25 - .54 [.40]	e.g. Once every ten years
2	Unlikely	.05 - .24 [.15]	e.g. Once every thirty years
1	Rare	.00 - .04 [.02]	e.g. Once every hundred years

Table 8: Severity of Consequence Description

CONSEQUENCE		
	Descriptor	Effect
5	Catastrophic	Project or program irrevocably finished
4	Major	Program or project re-design, re-approval; i.e. fundamental re-work
3	Significant	Delay in accomplishing program or project objectives
2	Minor	Normal administrative difficulties
1	Insignificant	Negligible effects

Table 9: Inherent Risk Ranking Description

RISK RANKING					
5	LOW	MED	HIGH	EXT	EXT
4	LOW	MED	HIGH	HIGH	EXT
3	LOW	MED	MED	HIGH	HIGH
2	LOW	LOW	MED	MED	MED
1	LOW	LOW	LOW	LOW	LOW
LIKELIHOOD	1	2	3	4	5
	CONSEQUENCE				

LIKELIHOOD (L) x CONSEQUENCE (C)		
Score	0 - 5 =	LOW
Score	6 - 10 =	MED
Score	12 -16 =	HIGH
Score	20 - 25 =	EXT

Figure 10 shows the next columns of the risk matrix. Each of them is explained in further detail below.

Figure 10: Next Portion of Risk Matrix

Initial Allocation under DB	Initial Allocation under DBFOMR	Treatment Description	Status

Initial Allocation: This refers to the initial allocation of the risk under the specific procurement models being analyzed. The possibilities are transferred, retained or shared.

Treatment Description: This is the field where potential management and mitigation strategies are described. These strategies are determined based on experience and knowledge pertaining to the risk event and relate to the Initial Allocation field. Even when a risk is transferred, this field needs to be completed as there still may be actions required in order to successfully transfer the risk at a reasonable price.

Status: This refers to the current status of the mitigation action. A risk can either be identified, active or treated, as described below.

Table 10: Status Option Descriptions

Options	Description
Identified	Risk that are known to exist but are expected to occur well into the future. The project has not yet moved forward into a phase where it makes sense to actively manage the risk.
Active	Risks that continue to exist and are being actively managed.
Treated	Risks that have been mitigated. Take a geotechnical risk, for example, where the mitigation strategy was to drill bore holes and distribute the data to proponents. Once this is done, the risk should be considered 'treated'.

In addition to the columns described above, project teams have the option of including additional information as they see fit to help make the risk matrix a more useful project management tool. For example, the following columns can be added at the Project team's discretion:

- a 'Risk Owner' column to assign people to manage specific risks;
- a 'Project Agreement' column that can describe during the procurement where in the contract a particular risk is addressed; and
- a 'Treatment Option' column with three separate possibilities:

- Accept and Influence: Refers to a risk that is best managed by the Province but is not under its direct control.
- Accept and Control: Refers to a risk that cannot be transferred to the private sector or that is best managed and mitigated by the Province.
- Transfer: Refers to a risk that can be transferred effectively to the private sector.

ATTACHMENT 2: PROJECT RISK MATRIX AND QUANTIFICATION WORKSHEETS

Note: Attachment 2 has been redacted in its entirety.

ATTACHMENT 3: RISK ANALYSIS PARTICIPANTS

Michelle Babiuk

Michelle Babiuk is a multi-modal transportation and infrastructure planner who currently leads the Environmental and Consultation programs for the Pattullo Bridge replacement project. Her previous experience spans the planning, construction and operation phases of transit, cycling and walking projects. Prior to joining the Pattullo Bridge team, Michelle managed the Transit Network Management group at TransLink. This team is responsible for developing near-term transit improvements, providing oversight through their implementation and monitoring their impacts. Before this, Michelle worked in Engineering & Infrastructure Management at TransLink, primarily leading feasibility studies for upgrades of passenger infrastructure. This involved working closely with municipalities and other stakeholders to integrate rail stations and bus exchanges with their surrounding land uses and street networks. Michelle received a Master's degree in Community and Regional Planning and a Bachelor's degree in English Literature from the University of British Columbia.

Derek Bacchioni

Derek has been the Treasury Manager of TransLink since October 2008. His responsibilities focus on cash management and short- and long-term borrowing. He played a key role in securing $500 million revolving line of credit and a $300 million inaugural 10-year bond for TransLink, the first offerings of this kind in the organization’s history. Since then he has been instrumental in the raising a further $880 million of bond financing for TransLink. He also worked on the TransLink financial evaluation team on the Golden Ears Bridge project and also helped with the value for money analysis of the Canada Line project. A chartered accountant by, Derek received his Canadian CA designation in 2000. Prior to joining TransLink in 1999, he worked at Canada Mortgage and Housing Corporation and prior to that spent 10 years working in corporate and investment banking in South Africa. Completing his South African Chartered Accountant designation in 1991, Derek articled with PriceWaterhouseCoopers and holds a Bachelor of Commerce and a Bachelor of Accounting from the University of the Witwatersrand in Johannesburg.

Aidan Ballentyne

Aidan has more than 25 years of experience in environmental management of large-scale infrastructure projects, primarily in the power and transportation sectors. His expertise includes regulatory requirements analysis, environmental planning, environmental risk assessment, environmental impact assessment (primarily to support project certification pursuant to Canadian Environmental Assessment Act and the BC Environmental Assessment Act) and environmental compliance management (including environmental oversight in a P3 project context). He has delivered these environmental management services to both public and private interests, under a variety of contractual arrangements (from DBB to DB to DBFOMR). As a result, Aidan has extensive practical knowledge of the many technical and contractual aspects of infrastructure project development. He is a practiced environmental team leader as well as a proficient strategist and technical writer.

Aidan holds a Master's Degree in Environmental Management from Simon Fraser University and is a member in good standing of the British Columbia College of Applied Biology.

Jeffrey Busby

Jeffrey Busby is the Director, Infrastructure Program Management, for TransLink. He leads a team responsible for development of transit, bike and road capital projects; asset management; bridge operations and maintenance; operation and management of TransLink-owned cycling facilities; and administration of multi-modal cost share programs.

His prior professional experience includes work in strategic and operations planning at the Chicago Transit Authority and as a consultant. Jeff holds a Master of Science in Transportation from the Massachusetts Institute of Technology and is a registered Professional Engineer.

Phoebe Cheung

Phoebe is a Transportation Engineer (P.Eng.) and Project Manager responsible for the Goods Movement Program in TransLink's Infrastructure and Network Management Division. She is a member of TransLink's Management Team for the Pattullo Bridge Replacement Project, responsible for the development and management of the project to meet the procurement requirements. Along with other members of TransLink's Management Team, Phoebe oversees the procurement and project development activities to ensure that the project achieves its scope, schedule and budget objectives.

Before joining TransLink in 2013, Phoebe worked as a consultant in SNC-Lavalin's Vancouver office. Phoebe has over ten years of experience in project management and transportation planning/engineering in an urban, multi-modal transportation environment.

Chris Chok

Chris is a partner with Kirk & Co., a strategic communications and consultation firm based in Vancouver, B.C. He has more than 10 years of experience in designing and implementing communications and consultation programs for major capital infrastructure projects and planning initiatives, including multibillion dollar PPP projects. Chris has advised owners and project teams regarding procurement communications, and has produced international bidder meetings for several major projects.

Chris has extensive experience across a variety of sectors, including transportation, energy, trade and others, skillfully managing communications and consultation programs to ensure that key stakeholders and the public have a variety of meaningful ways to provide input.

Fiona Cochrane

Fiona Cochrane is a Project Director at Partnerships BC, with a focus on the transportation, energy, and waste sectors. Fiona brings a strong financial, commercial strategy, economic and procurement background to projects with Partnerships BC's involvement. Since 2008, Fiona has been involved in the planning, procurement and delivery of a broad range of infrastructure projects in BC. Prior to joining Partnerships BC, Fiona worked as a Management Consultant with KPMG and Grant Thornton in Vancouver, focusing on strategic and business planning, and economic analysis.

Fiona is a Certified Professional Accountant (CPA) with a Bachelor of Arts degree in Economics and a Master of Arts degree in Environmental and Resource Management.

Caitlin Cooper

Caitlin is an accomplished public policy professional with more than 10 years of experience working with all levels of government to develop and implement strategic policies and plans. As a Senior Planner with TransLink, Caitlin's role with the Pattullo Bridge Replacement Project includes day-to-day oversight of the Environmental and Engagement work streams, and coordination of Business Case development. Prior to joining the Pattullo Bridge Replacement Project, Caitlin was a key member of TransLink's Strategic Planning and Policy team for five years. Through this role, she contributed to the development of all of TransLink's recent strategic plans, including Transport 2040, the Regional Transportation Strategy, the Mayors' 10-Year Vision, and annual 10-Year Investment plans (previous called Base Plans). Caitlin also project managed the development of the first-ever Regional Goods Movement Strategy for Metro Vancouver, which included extensive stakeholder consultation and inter-governmental coordination.

Ken Curry

Ken Curry is the Manager of Traffic and Transportation Planning for Parsons' BC Operations, a Vice President at the firm, and is also a senior transportation engineer with over twenty five years of experience in the planning and design of many roadway and transit related projects.

During his career, Ken has had the opportunity to manage many small and large transportation engineering assignments that involved complex analysis techniques, multiple account evaluations, preparation of functional designs, and business case development. Most of his recent projects have involved numerous stakeholders spanning many jurisdictional boundaries including traffic engineering for the $3.5+ Billion Gateway Program on behalf of the Ministry of Transportation and Infrastructure. Over the past eight years, he has led the multi-disciplinary Technical Consultant team for the replacement of the Pattullo Bridge on behalf of TransLink.

Marni Fedoruk

Marni has extensive experience in coordinating the environment components on complex provincial transportation projects. She has been involved in key Ministry of Transportation and Infrastructure major projects during project definition through the BC Environmental Assessment Act certification project, procurement and evaluation phases. Projects include Sea to Sky Highway Improvement Project, Port Mann Highway 1, South Fraser Perimeter Road. She also has a strong background with regulatory processes, communications and stakeholder engagement. Marni holds a bachelor in Anthropology from University of Victoria.

Trevor Fitzell

Trevor Fitzell is a principal operating within the geotechnical engineering group in Golder Associates' Vancouver office. His educational background includes a M.Sc. from Imperial College of Science & Technology in London, England, where he specialized in geotechnics and seismology. His experience in the field of geotechnical engineering is extensive and varied, spanning a period of 40 years.

Trevor has been responsible for management and review of many large multi-disciplinary infrastructure studies involving geotechnical and environmental engineering, seismic site response, and earthquake engineering. This includes geotechnical design for many municipal transportation projects as well as portions of most of the major highway improvement and major bridge projects undertaken in B.C. over the last few decades, including the Golden Ears Bridge, the Gateway Program (Port Mann Bridge and Pitt River Bridge replacements), Alex Fraser Bridge, Inland Island Highway, and the Barnet Highway. Many of these projects have involved various forms of delivery from design-bid-build, design-build and P3 procurement.

Adam Hempstock

Adam Hempstock is a Senior Associate at Partnerships BC, with a focus on the transportation, energy, and waste sectors. Adam brings a strong projects background to projects with Partnerships BC's involvement. Since 2006, Adam has been involved in the planning and delivery of a broad range of projects across North America. Prior to joining Partnerships BC, Adam worked as a Project Engineer with Amec Foster Wheeler in Vancouver, focusing on projects in the LNG, mining, and energy industries.

Adam is a Professional Engineer (PEng) with a Master of Engineering and Public Policy degree and is near complete his Master of Business Adminstration in Finance.

Wendy Itagawa

Wendy has extensive experience on complex infrastructure projects from both the private and public sectors. She has been involved on some of BC's largest public infrastructure projects during the definition, procurement, and implementation phases. As professional engineer, her experience includes design and management of major projects in transit, industrial, buildings, highways, and bridges. Her skill set includes strategic planning, technical design, procurement strategy, risk management and contract management. She also has a strong background with intergovernmental liaison, regulatory processes, communications and stakeholder engagement. Wendy holds both a bachelor and Master of Engineering in Civil Engineering from McGill University and is a registered Professional Engineer with APEGBC.

Robin Johnston

Robin Johnston has directed, managed and facilitated the development and implementation of many complex projects over the past 30 years. He has devoted much of that time to the development and delivery of major turnkey and public-private partnership (P3) programs and projects across Canada and internationally. In 1996, his technical team was retained by the New Brunswick Department of Transportation to develop the Fredericton-Moncton Toll Highway project and to manage its implementation to commissioning. In 2002, he was the technical and implementation manager for the Golden Ears Bridge Crossing. And in 2010, his team was retained jointly by owner and contractor as Independent Certifier for the Port Mann-Highway 1 Design-Build Project.

George Kyriakelis

George Kyriakelis is a Project Director at Partnerships BC, with a focus on the transportation and energy sectors. George joined Partnership BC in May 2013 and has been involved in the planning, procurement and implementations of several health, education, transportation and energy projects, at various roles such as financial modeler, evaluation manager, procurement director and owner's compliance manager. George Joined Partnerships BC from Peter Kiewit Infrastructures Group where he worked in various management capacities on some of the largest transportation projects in BC, including the Port Mann Highway 1 signature span, the Pitt River Bridge, and the Sea to Sky Highway Improvement Work Package 2 and the Sea to Sky Highway Improvement DBFO projects. George brings strong practical knowledge of planning, procurement and implementation of large heavy civil projects from both the owner's and contractor's side.

Alex Malyuk

Alex Malyuk (P.Eng) is a Senior Associate at Partnerships BC, with a focus on the transportation sector. He recently joined Partnerships BC and brings extensive past project implementation experience from large transportation projects in BC including Canada Line and the Evergreen Line Rapid Transit Project. Prior to joining Partnerships BC, Alex was a Project Engineer for SNC Lavalin Inc. where he was responsible for the management of commercial changes as well as leading the demonstration of monthly progress and payments for the Evergreen Line. With more than 10 years' experience in the planning, execution, and management of large complex heavy civil projects, Alex brings a pragmatic approach to balancing contractor and owner expectations.

Andrew McClune

Andrew is a Partner in KPMG's Global Infrastructure Advisory practice based in Vancouver. He is an astute financial and commercial manager who draws on over 20 years of experience in the negotiation, commercial evaluation and financing of multi-million dollar project finance and PPP projects:

- 8 years project finance/PPP advisory to public clients on large, complex international infrastructure projects;
- 7 years bid-side PPP financial structuring within a major UK PPP contractor; and
- 6 years project finance analysis and financial modeling within the international oil and gas sector.

Scott McFarlane

Scott MacFarlane is a Senior Advisor with TransLink's Stakeholder Engagement department specializing in government and stakeholder relations. He has more than 30 years of experience working with federal and provincial government ministries, agencies and Crown corporations including working as an Industrial Technology Advisor with the National Research Council of Canada Industrial Research Assistance Program. He was also a member of the TransLink team working on the Roberts Bank Rail Corridor program. MacFarlane holds a Certificate in Software Engineering from the University of British Columbia.

Jennifer Morland

Jennifer Morland is a Senior Communications Advisor with TransLink who specializes in strategic communications for capital projects. Jennifer is experienced in recognizing communications needs and risks, and developing and executing public affairs plans. Jennifer has worked with TransLink for over two years, developing strategic communications plans for engineering projects, including the Pattullo Bridge rehabilitation project.

Prior to joining TransLink, Jennifer worked as a Senior Communications Officer at Transportation Investment Corporation, the crown corporation responsible for managing the Port Mann/Highway 1 Improvement Project.

Ian Rokeby

Ian Rokeby (P.Eng., MBA, FEC) is a Principal Project Manager with Collings Johnston Inc., based in their Vancouver office. He has more than 35 years of experience in the management and execution of a wide range of planning, feasibility, design, and construction projects for transportation infrastructure in British Columbia and across Canada, including: major highway programs, transit systems, and marine terminals. He has extensive experience in the management and coordination of multi-disciplinary design teams executing major transportation projects.

Gord Ruffo

Gord Ruffo P.Eng. has over 30 years of experience in the construction industry with 24 of these years in management positions on highway infrastructure projects. He has worked on behalf of Owners and Contractors and has had the opportunity to work on multi-million dollar projects in both the private and public sectors. Gord is an experienced structural engineer and has worked on the delivery of projects that include design-build, design-bid-build and public-private-partnerships. His extensive background in infrastructure development has enabled him to effectively lead projects through all phases including concept development, procurement, design reviews, constructability reviews, development of traffic staging programs and construction. Over the course of his career, he has developed positive working relationships with many of the industry's lead designers and contractors. Key projects that Gord has been involved with include the Vancouver Island Highway Project (MoTI), Border Infrastructure Project (MoTI), Port Mann Highway 1 (MoTI), Pitt River Bridge / Mary Hill Bypass Project (MoTI), Cache Creek to the Rockies Program (MoTI) and Roberts Bank Terminal 2 (VFPA).

Matthias Schueller

Dr. Matthias Schueller, P.Eng. and VP with Parsons, is the Manager for the Structures Division in Vancouver, Canada and Practice Leader for Long Span Bridges. He has 25 years of experience in the design and construction engineering of complex bridges worldwide. He is the Engineer of Record of the Deh Cho Bridge, one of the longest cable-stayed bridges in North America.

Jemma Scoble

Jemma Scoble has extensive experience working in the area of Aboriginal engagement and consultation with a focus on major transportation infrastructure projects within the Lower Mainland. Examples of recent experience include: Port Mann Highway 1, South Fraser Perimeter Road and Pitt River Bridge projects, George Massey Tunnel Replacement Project, Evergreen Line Rapid Transit Project, DeltaPort Road and Rail Improvement Project, Roberts Bank Terminal 2 Project and the Centerm Expansion Project. Jemma has been involved in the successful delivery of Aboriginal consultation programs for projects undergoing federal and provincial environmental review and permitting processes. She has led Aboriginal consultation for Vancouver Fraser Port Authority's Habitat Enhancement Program and has over a decade of experience working with Aboriginal groups on habitat enhancement projects - including the Surrey Bend Enhancement Project, New Brighton Park Habitat Restoration Project, Glenrose Tidal Marsh Project, and Alex Fraser Tidal Wetland Project.

Jemma's experience also includes Aboriginal procurement, negotiation and implementation of project benefit agreements and managing the fulfilment of project-related commitments to Aboriginal groups. Through her work on transportation infrastructure projects to date, she has developed and managed an Aboriginal environmental training and employment program, worked with six First Nations on the creation of the Lower Fraser First Nations Fisheries Legacy Fund, and has overseen the collaborative planning and implementation of a First Nations recognition/interpretive site with seven Lower Mainland Nations. Jemma holds a Bachelor of Arts from McGill University, a Master of Applied Science from the University of British Columbia (UBC) and is currently pursuing a doctoral degree at UBC's School of Community and Regional Planning.

Tony Steadman

Tony Steadman is a Chartered Quantity Surveyor with over forty seven years of managerial and technical experience in the practice of cost management, estimating, and contract administration in the construction industry. In addition to working as a consultant, experience has been gained working for a contractor, and within a client's project management organization. Work experience has included twenty nine years based in Canada, ten years based in Africa, extended periods in the Far East with four years resident in Hong Kong, commencing work in the United Kingdom.

Work has covered the management and preparation of costs from the conceptual through tender and construction stages of major projects including all the transit projects within the Lower Mainland of British Columbia, a number of bridge projects including the Skytrain Bridge in New Westminster, Deh Cho Bridge in the Northern Territories, Groat Road Bridge in Edmonton, Lions Gate Bridge in Vancouver, and the Bennett Bridge in Kelowna. When estimates of costs are prepared, his work takes into account the outputs and costs of each resource together with construction methodology required to carry out each aspect of the work. Parallel experience includes contract administration, document preparation, and claims management. This experience has been combined for project cost control from initiating budgets, controlling costs during design and construction, preparing cost effective contract strategies, ensuring the contract documentation reflects the projects constraints and ideals effectively, and claims management during construction.

Murray Tekano

Murray has over 35-years with the British Columbia Ministry of Transportation and Infrastructure including Assistant Project Director for the Vancouver Island Highway and Senior Project Director for the $770 million Kicking Horse Canyon Project. Currently Executive Project Director with the Ministry of Transportation & Infrastructure, responsible for the Kicking Horse Canyon Phase 4 project and the Central Okanagan Planning Study he provides executive mentoring and project development advice to various provincial infrastructure project teams.

Vashti Thiesson

As a Senior Advisor with MoTI's Indigenous Relations Team, Vashti provides analytical support in the development of provincial and strategic level policy regarding the Ministry's engagement and Consultation with Indigenous communities. Her work as an archaeologist has provided her with significant experience working with Indigenous communities across BC and on major projects. Her skill set includes excellent collaborative skills, strong research and analysis abilities, and in-depth knowledge of the consultative process and regulatory requirements.

Stephen Tsuen

Stephen is a Senior Manager in KPMG's Global Infrastructure Advisory practice based in Vancouver. He has over 11 years of project finance experience and PPP advisory to public clients on large, complex international infrastructure projects. Stephen's expertise is in the areas of financial modeling, risk quantification (including Monte Carlo analysis), reviewing financial capacity of proponents, RFQ and RFP bid evaluation, development of payment mechanisms and advising on preferred proponent negotiations.

Prior to joining KPMG, Stephen was an Assistant Vice President in PricewaterhouseCoopers' Infrastructure and Project Finance group.

Steve Veinot

Steven Veinot (CPA, CMA, SCMP) is a Director within TransLink's Financial Services department and is responsible for the annual budget planning, forecasting, capital cost management, and government funding programs. As part of his role, Steve has overseen a number of complex financial modeling activities and multi-million dollar contract negotiations.

John Villamere

John Villamere is a senior environmental engineer who joined Hatfield Consultants in 1979 after working for the Government of Canada for 10 years. As a consultant, he has provided environmental management services to many private and public sector organizations and interest groups and has been responsible for leading several multi-disciplinary environmental teams in efforts to obtain project certification. For the past 15 years, he has worked primarily on transportation industry infrastructure projects. His primary expertise is in environmental management, stakeholder consultation, permit acquisition and compliance.

John holds a Bachelor of Engineering Science degree (1967) and a Master of Engineering degree (1968) from the University of Western Ontario in London, Ontario. He has been a member of the BC Association of Professional Engineers and Geoscientists since 1979.

Bita Vorell

Bita Vorell is a Senior Transportation Planner with the Major Investment Planning group at TransLink. She joined TransLink in 2010 and has been responsible for the planning, design and project management of small to large infrastructure projects. Her recent projects include developing a long-term service and infrastructure strategy for the Canada Line, and serving as TransLink's project manager for the business case phase of the Pattullo Bridge Replacement Project.

Bita holds a Bachelor of Arts from the University of British Columbia and a Masters of Urban and Regional Planning from the Queen's University in Ontario.

Ian Wardley

Ian Wardley is an economist, project manager and strategic advisor with more than 25 years' experience in a variety of assignments within Canada and the US with a particular emphasis on transportation and public transit infrastructure. During his career he has applied his education along with his strong project management and interpersonal skills to projects in the areas of transit, transportation, finance, design, engineering, and government.

Specifically, Ian's infrastructure project experience includes the Millennium Line and Evergreen Line SkyTrain projects, Edmonton's Valley Line LRT project, the Golden Ears Bridge project, and TransLink's Compass Card project. Ian's involvement in these projects, which include both traditional and Public Private Partnership projects, covers a broad spectrum of project-related activities from project set-up, developing and authoring business cases for a projects initial justification and funding, assessing various project delivery models including participating in risk workshops, liaising with public and private sector stakeholders, providing strategic advice regarding procurement process, authoring and reviewing procurement documents, assembling and managing multi-disciplinary project teams, and managing day-to-day issues necessary to ensure the project's success.

Gary Webster

Gary has been a practicing Professional Engineer for more than 25 years and has specialized in the organization, procurement and implementation of large scale infrastructure projects and, in doing so, he has worked for both the Public and Private sector participants. Gary has led the business case assessment, procurement and contract implementation stages for a number of Public Infrastructure Programs that have included all forms of contracting from conventional delivery through to some of the largest PPP transactions in Canada. His experience includes setting up program optimization systems, managing through the regulatory processes, risk assessment, obtaining government approvals, business case development, producing contract and procurement documentation, managing the selection process, engineering design, construction supervision, asset management, revenue collection systems and maintenance management. This experience has been gained across a variety of infrastructure sectors, including institutional, health, marine, transit, highway and bridges and water and wastewater.

Sany R. Zein, M.Eng., P.Eng.

Sany R. Zein is the Vice President of Infrastructure Management and Engineering at TransLink. Sany is responsible for capital project delivery, major project development, TransLink's Infrastructure Project Management Office, road and bicycle infrastructure funding programs, operations and maintenance for three major bridges, and the enterprise asset management program. Sany is a registered Professional Engineer with more than 25 years of experience in the private and public sectors, including project experience throughout Canada and the United States.