



Ministry of
Transportation
and Infrastructure

Millennium Line Broadway Extension Project

Procurement Options Identification Report

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EXECUTIVE SUMMARY

PURPOSE AND CONTEXT

The capital planning guidelines set out in the Capital Asset Management Framework (CAMF), Ministry of Finance Core Policies and Procedures, and Partnerships BC processes support the development of a procurement strategy that offers the best opportunity to successfully deliver the Millennium Line Broadway Extension Project (MLBE or the Project) in keeping with the procurement objectives and provide the best value to taxpayers.

A key element of a procurement strategy involves identifying the optimal procurement option(s) from among the full range of feasible options that could be adopted to deliver the Project. The purpose of this report is to identify a full range of feasible procurement alternatives and then narrow that range to two options to be examined and/or analyzed in detail for the Business Case. These include:

- one option representing a traditional public sector delivery model; and
- one option representing a partnership model with private finance.

The traditional public sector delivery model and the partnership model are respectively designated as the Public Sector Comparator (PSC) and the Shadow Bid (SB) in the Business Case analysis.

APPROACH

A total of five procurement options were identified as the most feasible for delivering the Project, given specific assumptions and positions developed through the engagement of project specialists, and from experience gained on other major transportation projects in BC and other jurisdictions.

Two options were identified for procurement under a traditional public sector approach:

- PSC#1 – Two distinct design-build (DB) contracts (one elevated guideway; and one for the underground portion of the works);
- PSC#2 – a single DB contract combining all major construction phase scope elements.

Three options were identified for procurement under a partnership model: two options for a construction period-only model with private finance, and one option for a long-term partnership model with private finance:

- SB#1 – Two distinct contracts, one DB contract for the elevated guideway, and one Design-Build-Finance (DBF) contract for the underground portion of the works which would include construction period only financing;

- SB#2 – One Design-Build-Finance (DBF) contract for all construction period scope elements, with private financing; and
- SB#3 – One Design-Build-Finance-Maintain (DBFM) contract for all construction period scope elements, including private financing and limited operating period scope which would include maintenance and rehabilitation requirements for the tunnel envelope and stations, excluding vehicle, tracks, and automated train control systems.

With reference to the procurement objectives, and considering key risks, coordination requirements and timing issues related to the Project, the full list of procurement options was analyzed and compared by application of a procurement options assessment matrix found in Appendix A. The assessment matrix required that Project team members consider the relative merits of each procurement option in terms of clearly articulated qualitative criteria.

RECOMMENDATION

The procurement options analysis, in support of the Business Case recommendation of a preferred procurement approach for the Project, should focus on the following delivery models:

- PSC#2 – a single DB contract combining all major construction phase Project scope elements; and
- SB#2 – One DBF contract for all construction period scope elements, with private financing.

Through the Business Case process, both of these options will be further defined in the context of the Project, specifically with consideration of the technical specifications and commercial positions being considered by the Project team in the development of the procurement documents. The procurement options analysis carried out for the Business Case will provide the substantive basis for recommending the model most appropriate for the procurement of the Project.

The following scope elements will be delivered outside of the two procurement model options identified above, through partnership agreements with the public utility owners and traditional contract structures.

- Property acquisition,
- Fare vending and gates (procurement only), and
- BC Hydro temporary and permanent power.

1 INTRODUCTION

1.1 PURPOSE

This report identifies a broad range of feasible procurement alternatives that could be adopted to deliver the Project, and then narrows that to two options deemed most appropriate for a more detailed analysis. From the recommendations of this report, a more comprehensive procurement options analysis will be undertaken comparing the preferred traditional and preferred partnership procurement options. The analysis will include a risk analysis and quantification, market sounding, multiple criteria analysis and financial modeling.

In keeping with current capital planning practices, and appreciating the unique characteristics of this Project, the procurement models to be examined and/or analyzed in detail for the Business Case should include:

- one option representing a traditional public sector delivery model; and
- one option representing a partnership delivery model with private finance.

The traditional public sector delivery model and the partnership model are respectively designated as the PSC and the Shadow Bid (SB) in the Business Case analysis.

1.2 PROJECT OVERVIEW

As outlined in the Mayors' Council Vision for Regional Transportation (2014), the Project will extend rapid transit westward from VCC-Clark Station along Broadway Avenue to Arbutus Street (Broadway Corridor), providing convenient, frequent, and rapid transit service and alleviating traffic congestion by removing the 99 B-line buses from the Broadway Corridor. The Project will expand the reach of the existing rapid transit network, delivering a reliable alternative to the single occupant vehicle for travel. The goals of the Project are to shape future land use, influence travel demand, increase ridership and reduce emissions.

The overall MLBE project includes a 5.7km extension of the existing Millennium Line from VCC-Clark Station to Arbutus Street along Broadway Avenue. The extent of the Project and its relation to the existing transit network is illustrated in the figure below.

Figure 1 MLBE Project Map



The Project includes the following major capital components:

- (a) Construction of six (6) underground stations,
- (b) Total of five km of tunnel ,
- (c) 700m of elevated guideway, and
- (d) Interconnection at VCC-Clark Station.

The capital budget for the Project is estimated to be in the order of \$2.8 billion.

1.3 STUDY APPROACH

The Project will be procured in a manner consistent with the guidelines set out in the CAMF, Ministry of Finance Core Policies and Procedures, and Partnerships BC processes, incorporating lessons learned on other major regional rapid transit projects in British Columbia.

These guidelines require the development of a procurement strategy that offers the best opportunity to successfully deliver the Project in keeping with the procurement objectives; and that provides the best value to taxpayers. A key element of developing the procurement strategy involves identifying the optimal procurement option(s) from a range of feasible options that could be adopted to deliver the Project.

In arriving at the recommended procurement options for detailed analysis, the following activities were carried out:

- **Project Scope Elements** – Description of key Project scope elements, in terms of how components might reasonably be separated and/or combined for the purposes of procurement.
- **Assumptions, Considerations and Risks** – Identification and review of key Project assumptions, considerations and risks relevant for procurement and project delivery.
- **Procurement Objectives** – Details of specific objectives that can be satisfied by the selection of a procurement model.
- **Procurement Options** – Describes features of the full range of procurement models, and summarizes the basis for developing a shortlist of the most practical procurement options for the Project.
- **Qualitative Assessment Criteria** – Development of a set of criteria to assess procurement options.
- **Assessment of Options** – Application of the qualitative assessment criteria to evaluate and rank the full range of procurement options, drawing on recent experience planning and implementing comparable large-scale transit projects.

All of these activities involved engagement with key specialists and senior Project personnel. Details of these activities and results are described in this report.

2 PROJECT DESCRIPTION AND SCOPE ELEMENTS

The Project consists of approximately six km of ALRT line and six stations under the existing roadways. Major underground works, such as twin bore tunnels and mined stations, is required to extend the existing ALRT Millennium Line system west to Arbutus Street and Broadway Avenue. All stations are underground with head-house structures similar to those constructed for the Canada Line project.

The key scope elements that are anticipated to comprise the Project are summarized below, and encompass the broadest scope of potential works considered in the *Strategic Options Analysis Report*.

- **Owner Directed Works** – works completed outside of the main contract(s) include:
 - Property acquisition,
 - Fare vending and gates (Procurement only), and
 - BC Hydro temporary and permanent power.

- **Elevated Guideway:** Construction of an approximately 700m above ground portion of the Project from VCC-Clark Station to the tunnel portal at Great Northern Way.

- **Underground Civil Works:** All works within the Project right of way for vehicle tracks, including tunnel and station excavations, tunnel lining, station structural concrete works, traffic management, utility relocations, track supply/install, and stations and ancillary facilities.

- **Architectural Finishes:** All non-structural components of the stations including the head-house design and construction.

- **Integrated Systems:** Integrated, including automated train control, communication, and power supply systems.

- **Operations:** Provision of all goods and services associated with the management, planning, and delivery of operations. TransLink will be responsible for operations and maintenance, and will set service schedules and fares.

- **Maintenance and Rehabilitation (M&R)** – preventative maintenance and lifecycle costs for replacement of major repair of capital components of the Project.

- **Rolling Stock M&R** - preventative maintenance and lifecycle costs for replacement of the vehicles operating on the Millennium Line.

3 PROJECT OBJECTIVES, CONSIDERATIONS AND RISKS

The assessment of procurement delivery models requires an understanding of key Project features to guide the shortlisting of models and the development of appropriate procurement objectives and evaluation criteria. These features are described in the following sections, and include the Project objectives established in earlier studies, and the key considerations and risks relevant to procurement.

3.1 PROJECT OBJECTIVES

The objectives for the Project were developed from previous studies and incorporated stakeholder and public input to ensure that underlying needs and issues were addressed. These studies undertook a corridor assessment of the current and expected conditions and synthesized problem statements in order to ensure that the rapid transit solutions identified and evaluated address the underlying needs and issues. The problem statements developed were:

- 1) Existing transit services do not provide sufficient capacity or reliable enough service to the major regional destinations and economic hubs within the Broadway Corridor;
- 2) Transit trips and mode share need to increase to reduce vehicle kilometers travelled (VKT) and GHG¹ and CAC² emissions, both directly and by supporting the Regional Growth Strategy and other regional objectives; and
- 3) Affordability - the limitation on regional funding for transit and the need to balance a range of investment priorities – was also identified as a regional problem for consideration; however, affordability requires understanding other regional needs and cannot be assessed within a single corridor study.

As part of the evaluation process for technical alternatives, a multiple account evaluation approach was utilized and the Project's problem statements were refined into more specific objectives across seven factors or "accounts". These accounts and account-level objectives are summarized in Table 1:

¹ Greenhouse gasses

² Criteria Air Contaminants

Table 1 - Project Account-Level Objectives

Account	High Level Project Objective	Resulting Project Outcome
Transportation	A fast, reliable and efficient service that meets current and future capacity needs, and integrates with the regional transit network and other modes.	The Region achieves its transportation targets, and strengthens the regional transit network.
Financial	The Project is affordable and cost-effective.	The Project demonstrates an effective use of public funds.
Environment	The Project attracts new riders and reduces vehicle kilometres travelled.	Project contributes to meeting wider environmental sustainability targets and objectives
Urban Development	The Project integrates with the surrounding neighbourhoods through high quality urban design.	Project supports current and future land use development along the Broadway Corridor, and supports the reduction of urban congestion.
Economic Development	The Project directly creates jobs and minimizes impacts on goods movement during operations.	The Project encourages economic development and improves goods movement within the Broadway Corridor.
Social and Community	A safe, secure, and accessible service that improves access to rapid transit for all, while managing impacts on heritage, local environments, and archaeology.	The Project increases foot traffic within the Broadway Corridor, and supports the development of public spaces and vibrant communities.
Deliverability ³	A service that is constructible and operable.	The Project is publicly accepted, through all phases, and perceived as a positive development for the Region.

³ As defined in Translink. (2012). UBC Rapid Transit Study Phase 2 Evaluation Report

3.2 KEY CONSIDERATIONS

The section describes the key assumptions and considerations that were identified by the Project team as being most relevant to assessment of procurement options. These assumptions and considerations included:

- Cost and schedule certainty are strongly desired at contract award to fulfill stakeholder expectations on project delivery.
- Due to the traffic congestion on the Broadway Corridor and the limitation reached in the service levels of the 99 B-line bus service, the model that delivers the Project sooner (including procurement) and with schedule certainty is more desirable.
- Under all procurement scenarios, the public sector would maintain ownership of the transit system (rights of way, vehicles, tracks) and would also set/collect fares and define service schedules.
- The procurement assessment for the Project will consider the potential expansion of the Millennium Line to UBC; however, as the timing of the decision has not yet been made, the best choice for the Project, as defined in this report, will be made.
- Interface management with the existing transit network is an important consideration as the Project must be constructed, operated and maintained within this network.
- Procurement model selection shall consider the Province of B.C.'s (the Province) experience procuring and delivering Advanced Light Rail Transit (ALRT) (SkyTrain) projects.
- Due to the integrated nature of the transit network as a whole and the Millennium Line in particular, the operations and maintenance of the vehicles, track and control systems can more efficiently be managed by British Columbia Rapid Transit Company (BCRTC) than by a special purpose vehicle set up for the sole purpose of managing the project assets. The Project represents an approximate 18% increase in the SkyTrain transit network. The Project team reviewed the analysis carried out for the Evergreen Line project in November 2008 and May 2009 and based on the results of those assessments, the team determined that the inter-operability and seamless interface of the expanded Millennium Line under one operator would maximize O&M efficiencies and user benefits. For further information, please review materials provided in Appendix B of this report.

3.3 KEY RISKS

Risk management is an essential process in project delivery, and this section summarizes those risks that were identified by the Project team as the most strategic in assessing procurement delivery options. A guiding principle of a procurement options assessment is to allocate risks to: (1) the parties that are best able to manage the risk, and (2) to a party that has strong incentives to do so. The procurement model selection is a means of efficiently allocating these risks. The key risks considered for the procurement assessment included:

- Completing construction with minimum disruption to road surface, and balancing flexibility for contractor innovation with effectively managing potential disturbance to the public.
- There are considerable geotechnical complexities and uncertainties associated with the underground construction scope.
- Interface and interaction with the Canada Line concessionaire, In-Transit BC.
- Managing the multiple interfaces between key project phases (i.e. design-construction, construction-operations) and between the major scope items (i.e. tunnelling, station mining, elevated guideway).
- Risk of schedule delays with required power upgrades by BC Hydro not being complete in time with the main contract(s).

4 PROCUREMENT OBJECTIVES

The establishment of procurement objectives is a standard practice to define the ultimate framework in which procurement options will be assessed. The objectives identified by the Project team are based on precedent for transit/transportation projects in B.C., the Project objectives, and the key considerations, including risks, for the Project. The procurement objectives selected are described below:

1. **Timely project delivery:** Provide certainty in terms of the Project implementation schedule. The shortest overall timeline (planning through to service commencement) for delivery of the Project is important as the Broadway Corridor is one of the most congested arterial roadways in the lower mainland;
2. **Cost effective implementation (design and construction):** Provide the most cost effective method to deliver the Project, in terms of budget certainty, including utilization of the owner's resources;
3. **Allocate key risks to the party best able to manage and mitigate them:** Ensure key Project risks are allocated in the most cost-effective way to the party that is best suited to manage them;
4. **Effective asset performance throughout the life of the asset:** Ensure best value in terms of balancing capital and lifecycle rehabilitation costs. Effective implementation will involve design influenced long term performance, including an increased probability that the asset will achieve the design service life;
5. **Efficient delivery of operations and maintenance services:** Ensure best value and efficiency in terms of balancing capital and ongoing operations and maintenance services;
6. **Operational integration:** Ensure integration of operations and maintenance with the existing transit lines with minimal disruption to existing service levels and operating efficiencies to BCRTC;
7. **Accommodate future system expansion:** Provide a mechanism for addressing potential future changes in the most cost effective and timely manner. Changes can range from service levels, to large capital investments such as additional station or the potential extension of the transit line to UBC;
8. **Attractive, marketable and bankable transaction:** Ensure a transaction that is fair, transparent and attracts national and international firms with a keen interest to participate and the capability to deliver a project of this size and complexity; and

9. **Attainable within fiscal constraints:** Ensure the approved budget is not exceeded and the Project can be delivered within affordability constraints. Public infrastructure approvals are based on cost estimates developed through comprehensive Business Case analysis.

5 PROCUREMENT OPTIONS

Procurement options for project delivery are determined based on the scope of project activities along with consideration of project characteristics, and best practices in procurement. The allocation of project risk to the private sector is a useful feature to compare when discussing differences between the various procurement options. Refer to Table 2 below for a summary of the various project activities and the allocation (risk transfer) to the private sector under both traditional and partnership procurement options.

Table 2: Allocation of Project Activities to the Private Sector by Procurement Option

Activity	Traditional Options		Alternative (Partnership) Options				
	DBB	DB	DBF	DBFM	DBFO	DBFOM	DBFOMR
Design		✓	✓	✓	✓	✓	✓
Design-Construction Coordination		✓	✓	✓	✓	✓	✓
Construction	✓	✓	✓	✓	✓	✓	✓
Commissioning	✓	✓	✓	✓	✓	✓	✓
Operations					✓	✓	✓
Maintenance and Lifecycle Costs				✓		✓	✓
O&M Coordination						✓	✓
Rehabilitation							✓
Short-term financing (construction)			✓	✓	✓	✓	✓
Long-term financing				✓	✓	✓	✓

The following sections discuss the key features of traditional and alternative (partnership) procurement models and summarize the scenarios shortlisted under each type for the qualitative assessment process.

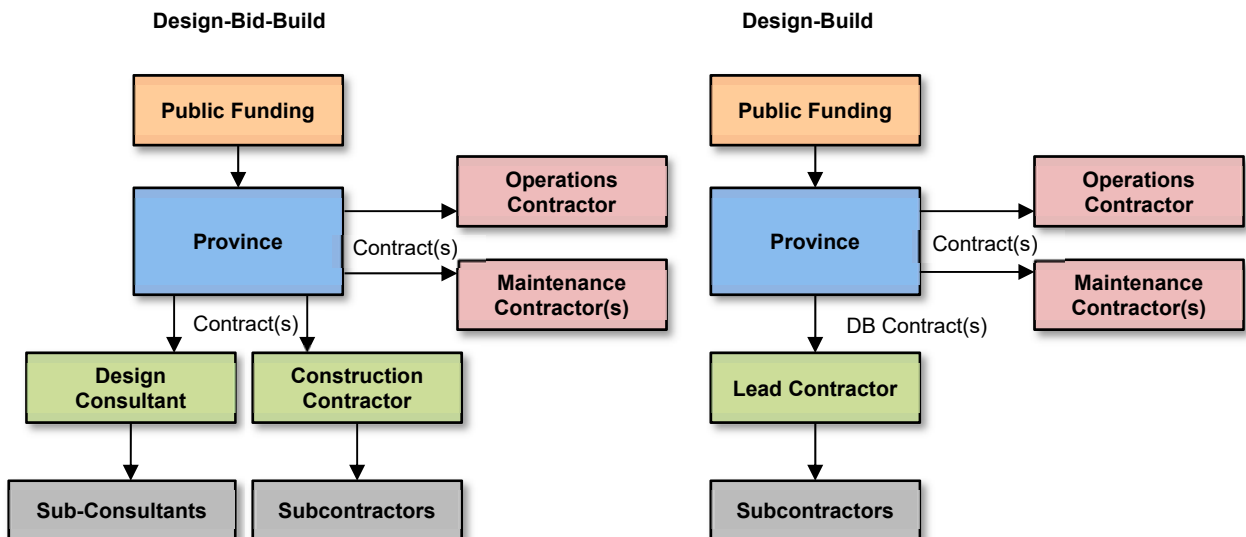
In addition to consideration of various procurement models, the procurement options assessment evaluated various combinations of the major scope elements delivered by separate contractors. For large transit projects, this is generally a separation of the vehicle supply from the tracks, including the associated civil works. In some instances a further breakdown of major civil works, such as stations, maintenance facilities, tunnels, and elevated crossings may also be appropriate.

5.1 TRADITIONAL PUBLIC SECTOR DELIVERY MODELS

As indicated in Section 1.3 of this report, the detailed procurement options analysis for this Project will include one procurement option representing a traditional public sector delivery model (PSC).

The PSC models considered included delivery through either a DBB, DB or a combination of these contract arrangements. Figure 1 below depicts the typical contracting structure for these types of delivery models.

Figure 2 - DBB and DB contract structures



Typically, the Province will enter into a DBB or DB contract with one or more private sector contractors to deliver the design and/or construction. The contractor will have the responsibility of designing (in the case of a DB) and/or building (in the case of both) a project, and will typically subcontract where necessary to acquire capability and expertise. The Province will pay the contractor as agreed in the contract, either as progress payments or as key milestones are achieved. The Province will then enter into a separate contract(s) for the delivery of operations and maintenance services during the operating period. Rehabilitation risk remains with the Province.

In determining the PSC, the Project team considered drawing on experience procuring other major transit projects in B.C. and other jurisdictions, how the construction period scope elements might be isolated or combined for the purposes of procurement under a traditional model. The Project team included, among the range of scope combinations, as many options as might reasonably be considered for this Project.

5.1.1 Key Assumptions and Positions

The main assumptions and positions underpinning the short-list of PSC options include:

- Without a long-term financing component, the operations, maintenance and lifecycle scope would not be combined with a construction phase contract. The Province would either self-perform or contract separately these post-construction phase activities.
- The PSC would be a DB, rather than a DBB, due to limitations of the Province’s resources and expertise in delivering a project of this size under a DBB model, and the greater cost and schedule certainty with a DB model. See Section 5.1.3 of this report for more detail.
- For reasons of logistics, risk transfer and efficiencies the project is better delivered as a single project rather than multiple projects.
- The size and complexity of the elevated guideway is not sufficient enough to provide significant opportunities for innovation and risk transfer.

5.1.2 PSC Procurement Models

The Project team identified two options, determined to be the most feasible, for procurement under a traditional model as shown in Table 3 bellow. In all cases, there is no private finance at-risk, and the contractors do not have any operating period responsibilities beyond the warranty period.

Table 3 - Short Listed Traditional Models for Public Sector Comparator

Scope Item	PSC#1 – 2 DB Contracts	PSC#2 – 1 DB Contracts
1. Utility Relocates	DB#1	DB#1
2. Stations (Civil Works)		
3. Tunnel, Track & Systems		
4. Head Houses (Architectural)		
5. Control Centre Upgrade		
6. Transit Exchange		
7. Elevated Guideway (~800m)	DB#2	
8. Operations & Maintenance Tunnel & Stations	TransLink / Province	TransLink / Province
9. Operations & Maintenance Vehicles, Track & Systems		
10. Systems Expansion		
11. Public Art		
12. Fare Collection / Equipment	Province (Purchase) DB#1 (Install)	Province (Purchase) DB#1 (Install)
13. Property Acquisition	Province / COV	Province / COV
14. Building Demolition & Contaminated Site rehab (Arbutus & GNW)	DB#1	DB#1
15. Power Upgrade	TransLink / BC Hydro	TransLink / BC Hydro

5.1.3 Design-Bid-Build

The Project team gave consideration to the incorporation of a DBB element into the project. The key reasons for eliminating DBB as a procurement option are:

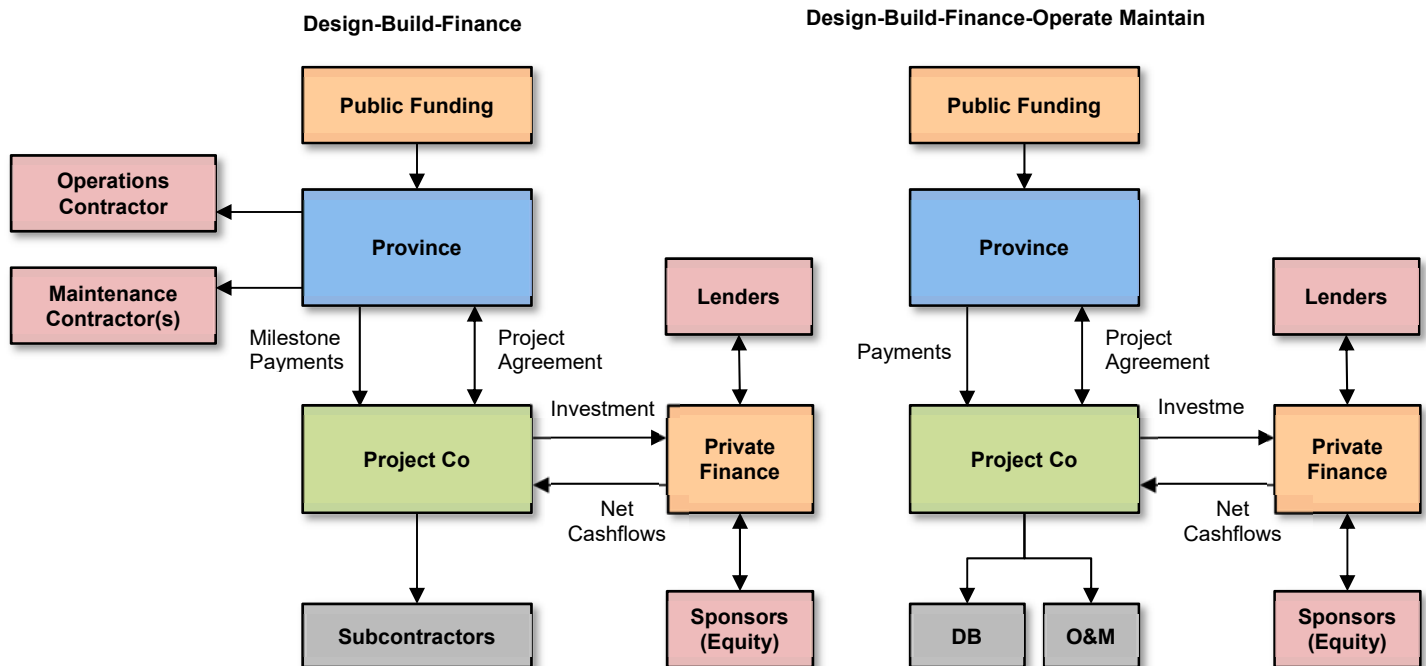
- The Province has successfully delivered major capital infrastructure project of this size as DB's and would not revert to a DBB, in part as it would not have the internal capacity immediately available to develop or manage the design or deliver this Project under the current timeline using such a procurement model;
- With the B-line bus service at maximum capacity and congestion impacting the environment and development along the Broadway Corridor, procurement models with faster overall schedules (planning, procurement, construction) and with greater track record of on time delivery are preferred; and
- Limited funding resources and inability to raise funds outside the potential federal and committed provincial amounts, favours project delivery models with greater cost certainty.

5.2 PARTNERSHIP DELIVERY MODELS

The detailed procurement options analysis for this Project will examine one procurement option representing a construction period-only partnership delivery model, or one long-term partnership delivery model. One of these options will be identified as the Shadow Bid since the modeling carried out during detailed procurement options analysis is intended to mimic the behaviour of contractors in their bids. The assessment will determine whether the construction period-only partnership model or the long-term partnership model is identified as the SB and analyzed in detail in the Business Case analysis.

The SB models considered included delivery through DBF in the case of construction period-only contracts, and DBF plus a number of operating period responsibilities such as operations, maintenance and rehabilitation (DBFOM, DBFM), in the case of long term partnership agreements. Figure 2 below depicts the typical contracting structure for these types of delivery models.

Figure 3 - Example Partnership contract structures



Under a partnership delivery model, the Province would enter into a Project Agreement (PA) with a private sector partner (Project Co). Project Co would be required to design, build, and (where applicable) operate, maintain and/or rehabilitate the Project over the life of the PA. Project Co would enter into a series of contracts as required with service providers for design, construction, operations, maintenance and/or rehabilitation, and would finance the design and build costs through a combination of equity, debt and/or other forms of finance raised from sponsors and third party lenders. Project Co will be paid as set out in the PA at substantial completion or key milestones during construction and regularly during operations within the life of the PA for long-term partnerships.

As indicated in Section 1.1 of this report, the purpose of this report is to recommend a preferred partnership procurement option for a more detailed evaluation against the PSC in the Business Case. The preferred partnership option is referred to as the Shadow Bid (SB) since the financial modelling carried out during the Business Case assessment is intended to mimic the behaviour of a private sector contractor's bid. The following sub-sections describe the process used to short-list partnership procurement options for a multi-criteria assessment contained in Section 6.

5.2.1 Key Assumptions and Positions

The main assumptions and positions underpinning the list of SB options included that:

- The same assumptions regarding how scope elements might be combined under a traditional procurement approach would also apply under a partnership delivery model approach.
- The value of including private financing in a contract is realized where finance at-risk can be effective for securing the transfer of key Project risks, and where traditional forms of security may not be adequate.
- If a long-term partnership were considered, it is likely that the PA would include at least some asset rehabilitation scope to ensure effective risk transfer.

5.2.2 SB Partnership Models

The Project team shortlisted three options for procurement under a partnership model as shown in the table below.

Table 4 - Short Listed Partnership Models for Shadow Bid

Scope Items	SB#1 – 1 DBF and 1 DB Contracts	SB#2 – 1 DBF Contracts	SB#3 – 1 DBFM Contracts
1. Utility Relocates	DBF	DBF	DBFM
2. Stations (Civil Works)			
3. Tunnel, Track & Systems			
4. Head Houses (Architectural)			
5. Control Centre Upgrade			
6. Transit Exchange			
7. Elevated Guideway (~800m)	DB		
8. Operations & Maintenance Tunnel & Stations	TransLink / Province	TransLink / Province	TransLink / Province
9. Operations & Maintenance Vehicles, Tracks & Systems			
10. Systems Expansion			
11. Public Art			
12. Fare Collection / Equipment	Province (Purchase) DBF (Install)	Province (Purchase) DBF (Install)	Province (Purchase) DBFM (Install)
13. Property Acquisition	Province / COV	Province / COV	Province / COV
14. Building Demolition & Contaminated Site rehab (Arbutus & GNW)	DBF	DBF	DBFM
15. Power Upgrade	TransLink / BC Hydro	TransLink / BC Hydro	TransLink / BC Hydro

5.2.3 Design-Build-Finance-Operate-Maintain

The Evergreen Line Project (ELP) is an 11-kilometre extension of the Millennium Line to the northeast of the transit network that includes a 1-km long tunnel and six new elevated stations, and was delivered as a DBF with the public sector as the intended operator. Due to the similarities in the nature of the Evergreen Line Project and the Project, the Project team conducted an extensive review of the procurement options assessments carried out in November 2008 and May 2009 for the operations and maintenance scopes for the Evergreen Line Project. This review included consideration of options to include maintenance as part of the procurement (DBFM) versus the DBF option that was selected for the Evergreen Line Project.

Based on the results of the assessments undertaken for the Evergreen Line Project, the Project team determined that the conditions leading to the selection of a DBF procurement model had not changed since the analysis was carried out. Furthermore, given the similarities between the two projects, the project team concluded that the DBF procurement model was also the most suitable option for the Project. As with the Evergreen Line, operations were also excluded from the Project delivery options given the inter-operability and physical interface between the Project and the existing SkyTrain network operated by the public sector. This seamless integration between the new line and the existing SkyTrain system resulting from a single operator is captured in the ridership projections prepared for this Business Case and maximizes user benefits.

The analysis concludes based on the O&M costs for the entire SkyTrain network, the added forecasted O&M costs for the additional 11km extension and 6 new stations, and the added costs of constructing a new Operations and Maintenance Center to accommodate the Private Partners O&M services, the Private partner through their Special Purpose Vehicle (SPV) would have to perform the same services as BCRTC approximately 60% more efficiently.

6 ASSESSMENT OF OPTIONS AND RESULTS

6.1 ASSESSMENT CRITERIA

In narrowing the shortlisted range of procurement options described in Section 5, the Project team developed a set of well-defined assessment criteria to provide an analytical framework for evaluating procurement options. The assessment criteria and their linkage to procurement objectives are summarized in Table 5.

Table 5 - Options Assessment Criteria

Assessment Criteria	Relevant Procurement Objectives
Minimizing disruption to the operation of the existing rapid transit (RT) network (Millennium & Expo Lines) <i>Ensure integration of the RT network expansion has the least impact to the current and future BCRTC operations.</i>	6. Operational integration
Key Project risks are managed and mitigated <i>Ensure that key Project risks, including geotechnical, are allocated to the party best able to manage and mitigate them.</i>	3. Allocate key risk to the party best able to manage and mitigate them
Competition, providing innovation and efficiencies, is maximized <i>Ensure an attractive, marketable and bankable transaction that brings innovation, efficiencies and value to taxpayers.</i>	8. Attractive, marketable and bankable transaction
Cost certainty, schedule certainty and affordability are maximized over the full life of the asset <i>Ensure that the Project is delivered on time and on budget within fiscal and cash flow constraints.</i>	1. Timely project delivery 2. Cost effective implementation 9. Attainable within fiscal constraints
Ability to implement changes during the life of the Project in the most cost effective manner <i>Ensure that the implementation of changes in service levels or future capital investment in the asset can be achieved in the most cost effective and efficient manner.</i>	7. Accommodate future system expansion
Corridor service quality and full life asset performance are maximized <i>Ensure that the asset performs effectively during operations and that O&M services along the entire network are delivered optimally.</i>	4. Effective asset performance throughout the life of the asset 5. Efficient delivery of operations and maintenance services

The assessment template required that Project team members consider the relative merits of each procurement option in terms of these qualitative criteria. All five procurement options identified by the Project team as feasible alternative approaches for delivering the Project were assessed in relative terms.

6.1.1 Assessment Scale

An assessment scale was applied to represent the extent to which each option addresses each criterion, with reference to the specific procurement objectives associated with each category. The following scoring framework provided the basis for the qualitative assessment:

- x Ineffective in satisfying the criteria.
- ✓ Partially effective in satisfying the criteria.
- ✓✓ Substantially effective in satisfying the criteria.
- ✓✓✓ Fully effective in satisfying the criteria.

6.1.2 Scoring and weighting

Partnerships BC does not recommend weighting and scoring the criteria numerically for the following reasons:

- Numerical scoring is not sufficiently flexible to allow for consideration of situational nuances in what is essentially a qualitative exercise. The assessment scale is heavily supported by the qualitative discussion and notes set out in Appendix A;
- The procurement options assessment is developed in a workshop format, with key positions and assumptions explicitly noted in this report. A numerical result may be interpreted with a false level of precision; and
- Weighting the relative importance of the criteria removes flexibility in decision making from the decision makers. Decision makers likely have different priorities and the procurement options assessment process should be sufficiently flexible to allow decision makers to evaluate the relative importance of the criteria on their own.

6.2 KEY POSITIONS

The following key positions underpinned the qualitative assessment:

- **Fewer contracts are preferred to multiple contracts** – Coordination and schedule risks, inconsistencies among contractors in addressing stakeholder communications requirements, and traffic management risks are negatively impacted by having multiple contractors whose activities must interface with one another. In addition, interface risks associated with multiple

- simultaneous contracts will need to be managed by the Province, drawing heavily on internal management resources.
- **The transfer of key Project risks is effectively secured by including private finance, both during construction and over the term of the contract** – Construction period procurement options that include private finance benefit from the discipline imposed by private lenders, including schedule certainty. The benefits of securing operating period Project risks with private finance include improved asset quality and performance over the long term.
 - **The involvement of large national or international contractors, improves competition** – Larger and stronger pool of contractors with the capacity and experience needed to deliver a project of this scope and scale benefit the competitiveness of the procurement process by bringing innovation and efficiencies in staging, resources, mobilization, construction methodology and innovations in design and implementation. Subcontracting opportunities are also provided for capable local contractors.
 - **System interoperability is greater when the public sector retains operating scope** – The Project is a physical extension of an existing transit system and will require the management of significant interfaces with the existing systems under the control of the BCRTC. It is assumed that introduction of a third party operator would increase challenges in negotiating smooth operations.
 - **Including operations and maintenance (O&M) responsibilities in the contract supports lifecycle performance of the asset** – The quality of O&M activities undertaken on the system components will have a direct impact on rehabilitation requirements and, accordingly, the service life of the asset. By transferring both O&M and rehabilitation risk to the contractor, there is an optimal alignment of interests supporting a full life cycle view of the Project and assure that assets are fully funded through the term of the contract.
 - **Long-term partnerships with O&M and lifecycle responsibilities incentivize greater quality** – Warranties on major transportation assets can be relatively short (1-2 years) with construction period only contracts. Including O&M responsibilities in the contract incentivizes Project Co to consider these aspects in design and construction. Long term partnerships incentivize Project Co and their design-builder to take a long-term view of asset quality and performance during design and construction.
 - **Flexibility to make changes to the Project at all stages, including system expansion, is greater under traditional delivery models than under long-term partnership delivery models that include operations period responsibilities** – The inclusion of private finance and

operating period responsibilities in the contract make any post-procurement changes to the Project more complex and costly.

6.3 SUMMARY OF RESULTS

The results of the procurement options assessment exercise are detailed in Appendix A, and summarised Table 6 below. The qualitative assessment for the PSC and SB options was carried out simultaneously as the progression from PSC#1 on the left to SB#3 on the right represented an incremental change to the project delivery method. However, the qualitative scoring alone does not indicate the final preferred option, as additional factors, particularly a quantitative assessment, must be assessed before narrowing the procurement option to a single model. This step of comparing the recommended PSC against the recommended SB is completed in the Business Case report.

Table 6 - Summary of Assessment Results

Assessment Criteria	PSC #1	PSC #2	SB#1	SB#2	SB#3
Minimizing disruption to the operation of the existing rapid transit (RT) network (Millennium & Expo Lines)	✓✓	✓✓✓	✓✓✓	✓✓✓	✓
Key Project risks are managed and mitigated	✓	✓✓	✓✓	✓✓ ^{1/2}	✓✓ ^{1/2}
Competition, providing innovation and efficiencies, is maximized	✓	✓	✓	✓	✓✓
Cost certainty, schedule certainty and affordability are maximized over the full life of the asset	✓	✓	✓✓	✓✓	✓✓✓
Ability to implement changes during the life of the Project in the most cost effective manner	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓
Corridor service quality and full life asset performance are maximized	✓	✓	✓	✓	✓✓

The following procurement options are recommended for detailed procurement options analysis in the Business Case.

6.3.1 Preferred Traditional Public Sector Delivery Model

The assessment highlighted PSC#2, a single DB contract, encompassing the full scope of design and construction activities, as the preferred public sector comparator. Under this model, the public sector would be responsible for all operating period activities (O&M); however, key risks associated with late delivery and commissioning of the whole systems have been transferred to the DB Contractor.

Relative to the other PSC option, this option scored equal or better against all assessment criteria.

The primary advantage of this option relative to the other PSC option was the transfer of the coordination with multiple contractors' related risk to the private partner.

6.3.2 Preferred Partnership Delivery Model

The assessment highlighted SB#2, a single DBF contract encompassing the full scope of design and construction activities plus private financing, as the preferred partnership model. Unlike the PSC options, the preferred SB option did not score greater than the other SB options for all criteria. The short-term nature of the DBF makes the procurement delivery option more amenable to change, which includes future system expansion and adjustments required to address integration and interoperability within the existing transportation network. Although the SB#2 option has strength in delivering the project on time and on budget, it was not the highest rated option for effectively managing key risks, fostering innovation, and maximizing asset performance over the full life cycle. However, as the Project is the third phase of the Millennium Line with more phases contemplated, the benefits of a long term partnership model were evaluated against the contractual constraints over the period associated with the longer-term partnership models, such as the decrease in flexibility and/or increase in costs of managing operational changes and system expansions during the operating period on the partnership.

6.3.2.1 Design-Build-Finance-Maintain

The Project team requested that the technical and business advisors identify the key project elements that would be included in the maintenance scope for a DBFM model along with the associated risks that this would enable the Province to transfer. The major scope elements identified were primarily related to the tunnel and station envelopes and mitigated the potential risk and consequences associated with water ingress, and the maintenance of additional station elements including elevators and escalators.

The expected values of the maintenance and rehabilitation scope, the risk associated with patent and latent defects with the tunnel and station envelopes, and the expected timeline within which these risks would typically be encountered were calculated. Based on this calculation, the Project team determined that the value of risk that would be transferred for such a limited maintenance and rehabilitation scope would not justify the costs anticipated under a long-term partnership model, in particular given the additional interface risk between a private maintenance provider and the operator (BCRTC) that would be required under such an arrangement. Please review the memorandum entitled "MLBE – Maintenance and Rehabilitation Risk Transfer" attached as Appendix B for more detail.

Due to the added costs and qualitative dis-benefits resulting from this division of maintenance and operations responsibilities, including those responsibilities that are interdependent, in such an integrated transit system, a DBFM model is not recommended for the Project. Additionally, the long-term performance risks associated with the SkyTrain network, which has been operating in the region for over

30 years, are somewhat limited. Furthermore, with each extension to the existing SkyTrain network, these risks have diminished while the efficiency of operations has progressively improved.

6.3.2.2 Key Qualitative Benefits of Design Build Finance

A DBF model is similar to a DB option, with the addition of private financing of a portion (or all) of the capital requirements during construction. The private finance is typically repaid on completion, with the potential for partial hold back during the warranty period that is typically two years, but can be as long as five or even 10 years depending on the components under warranty. Beyond the warranty period, there is no long-term recourse during operations under this option. Some of the key features of a DBF procurement model are provided below.

Lender Due Diligence

A key benefit of DBF procurement involves transferring much of the contractor interface during construction from the Owner to the lenders. Lenders work proactively to minimize their risk by improving completion (i.e. repayment) certainty through understanding, anticipating and reducing the likelihood of scenarios that may cause the work to exceed the Project budget and/or schedule. Exceeding the budget and/or schedule can result in financial penalties or delayed repayment that would reduce lenders' return. Lenders are largely independent of the working relationship between the contractor and Project and must rely on the formal project agreement to define and enforce the protections against their risks. By protecting their interests in this way, lenders play an important role in providing additional due diligence with respect to procurement and construction oversight that supports the work done by the Project Team. In order to help lenders assess their risks in financing a project, and ensure that it is being appropriately planned and priced, they will typically rely on:

- Quantity survey review;
- Specialist engineering review; and
- Project schedule and financial modelling.

This additional due diligence provides a complementary perspective to that of the Owner, that leads to improved focus on the part of the DB contractor and supports improved cost and schedule certainty.

The DBF procurement provides the DB contractor with greater incentive to meet the terms of the project agreement and complete on schedule given that the added interest cost generated as a result of changes or delays are payable by them, along with penalties for late completion. On a project the size of the Project, with construction costs budgeted at close to three billion dollars, the magnitude of these benefits can be amplified, as any delay would likely have a significant impact on the overall cost of the Project.

Also, by transferring more of the risk associated with increased cost under a DBF than a DB, the Project can be expected to benefit from greater certainty of achieving the Project budget during construction, often the stage in a project's development with the most risk.

Limiting Scope Change

Lenders are reliant on the terms of the project agreement and therefore enforce those terms holding both the Owner and contractor accountable. In this manner, DBF procurement can reduce the likelihood that the Owner and/or the contractor would intervene in a project once construction has started (e.g. scope changes), given that any changes could result in delays to the schedule and require changes to the project agreement that would result in additional cost. As the lenders are party to the PA, they have the opportunity and incentive to minimize such changes.

Enforceability

Additional DBF benefits can accrue to a project by avoiding some of the enforceability issues that arise under DB contracts. In situations where the Owner seeks to recover costs, a process begins whereby the Owner and contractor assess the reasons for any shortcomings, and allocate damages depending on which party is deemed responsible. This responsibility assessment and allocation process is often difficult and time consuming which can delay a project.

Under a DBF procurement, where repayment of the private financing is withheld to the end of construction, the contractor remains at risk and incurs interest charges as a result of delays. This feature provides additional incentive for a DBF contractor to avoid situations where there would be a potential for the Owner to seek damages and also provides incentive for the contractor to resolve issues more quickly should they arise.

Burden of Proof

An additional benefit of DBF procurement arises with respect to transferring the burden of proof to the primary contractor when there is a major problem. If an issue arises the private sector lender's financing is at risk and the lender will need to initiate and pursue action against the DB contractor's security package. When a major problem occurs under a DB resulting in claims against the DB contractor's security package the Owner bears the burden and risk of pursuing the legal action required to recover costs.

Timing of Contract Protections

A final benefit from DBF procurement can arise in relation to the timing and execution of contract protections by the public sector under a DB (i.e. they may take longer). As the private lenders may

perceive themselves to have a more immediate and significant financial incentive to aggressively pursue contract protections under a DBF, the risk and cost of delaying such action would be reduced.

7 NEXT STEPS

The two preferred procurement options identified in this report will be analyzed in detail through risk quantification, financial modeling and other procurement options assessment activities described in the Business Case. This detailed analysis will provide the substantive basis for recommending the model most appropriate for the procurement of the Project.

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APPENDIX A – DETAILED NOTES IN SUPPORT OF PROCUREMENT OPTIONS ASSESSMENT RECOMMENDATIONS

	PSC#1 – 2 DB Contracts	PSC#2 – 1 DB Contract
<p>Minimizing disruption to the operation of the existing rapid transit (RT) network (Millennium & Expo Lines) <i>Ensure integration of the RT network expansion has the least impact to the current and future BCRTC operations.</i></p>	<p style="text-align: center;">✓✓</p> <ul style="list-style-type: none"> During construction, integration will be facilitated by the output specifications and the contractors' detailed designs However, integration may be more difficult during the construction phase due to interface of multiple contractors the public sector will operate the system, with control of, and ability to optimize, scheduling as well as at-grade operations, including traffic, pedestrians and the broader transportation network 	<p style="text-align: center;">✓✓✓</p> <ul style="list-style-type: none"> Comparable to PSC#1, except that integration should be improved due to single contractor interface
<p>Key Project risks are managed and mitigated <i>Ensure that key Project risks, including geotechnical, are allocated to the party best able to manage and mitigate them.</i></p>	<p style="text-align: center;">✓</p> <ul style="list-style-type: none"> Interface risks due to multiple contracts DB contracts will likely involve holdback provisions but no private financing to secure performance the public sector retains all risk associated with operations, maintenance and rehabilitation 	<p style="text-align: center;">✓✓</p> <ul style="list-style-type: none"> Comparable to PSC#1, but limited construction period interface risk due to single DB contract
<p>Competition, providing innovation and efficiencies, is maximized <i>Ensure an attractive, marketable and bankable transaction that brings innovation, efficiencies and value to taxpayers.</i></p>	<p style="text-align: center;">✓</p> <ul style="list-style-type: none"> reasonable expectation that there is sufficient market interest to generate competitive bid less opportunity for innovation with separation of vehicle supply from tracks however, DB is based on an output-, rather than an input-based specification (such as under a DBB) and will facilitate some construction period innovation 	<p style="text-align: center;">✓</p> <ul style="list-style-type: none"> Some potential for innovation and efficiency through integration of all construction elements into a single package
<p>Cost certainty, schedule certainty and affordability are maximized over the full life of the asset <i>Ensure that the Project is delivered on time and on budget within fiscal and cash flow constraints.</i></p>	<p style="text-align: center;">✓</p> <ul style="list-style-type: none"> Greater risk of cost/schedule overruns with higher number of discrete contracts, plus added risks due to additional contractor interfaces on major scope items Absence of long-term obligations may impact contractor's approach to design and construction and could increase OMR costs during operations Lack of private financing reduces incentives for schedule certainty, unless significant liquidated damages tied to on-time delivery 	<p style="text-align: center;">✓</p> <ul style="list-style-type: none"> Comparable to PSC#1 for this criterion Single point of accountability and coordination increases probability of on time and on budget delivery
<p>Ability to implement changes during the life of the Project in the most cost effective manner <i>Ensure that the implementation of changes in service levels or future capital investment in the asset can be achieved in the most cost effective and efficient manner.</i></p>	<p style="text-align: center;">✓✓✓</p> <ul style="list-style-type: none"> project can be delivered under this model with no restriction on future expansion 	<p style="text-align: center;">✓✓✓</p> <ul style="list-style-type: none"> Comparable to PSC#1 for this criterion
<p>Corridor service quality and full life asset performance are maximized <i>Ensure that the asset performs effectively during operations and that O&M services along the entire network are delivered optimally.</i></p>	<p style="text-align: center;">✓</p> <ul style="list-style-type: none"> Long term asset performance / quality risk rests with the public sector; contractor will not be motivated to optimize the long term performance of the asset Multiple contracts reduces the incentives by construction contractors to optimize asset performance over the full lifecycle 	<p style="text-align: center;">✓</p> <ul style="list-style-type: none"> Comparable to PSC#1 for this criterion, except single DB contract will better facilitate asset optimization

	SB#1 – 1 DBF + 1 DB Contract	SB#2 – 1 DBF Contract	SB#3 – 1 DBFM Contract
<p>Minimizing disruption to the operation of the existing rapid transit (RT) network (Millennium & Expo Lines) <i>Ensure integration of the RT network expansion has the least impact to the current and future BCRTC operations.</i></p>	<p>✓✓</p> <ul style="list-style-type: none"> Comparable in effectiveness to PSC#1 	<p>✓✓✓</p> <ul style="list-style-type: none"> Comparable in effectiveness to PSC#2 	<p>✓</p> <ul style="list-style-type: none"> Integration and Interoperability in the development of the infrastructure comparable to PSC#2 & SB#2 <ul style="list-style-type: none"> Post construction, a limited maintained and rehabilitations scope will be the responsibility of the contractor. This contractual interface will reduce the public sector's flexibility to operate and optimise operations The project is a part of a very integrated system and there are costs/inefficiencies and qualitative dis-benefits as a result of breaking up responsibilities for maintenance and operations. There are limited long-term performance risks associate with the SkyTrain system, and there are progressively fewer risks as the system becomes better understood and O&M become more efficient with each progressive project
<p>Key Project risks are managed and mitigated <i>Ensure that key Project risks, including geotechnical, are allocated to the party best able to manage and mitigate them.</i></p>	<p>✓✓</p> <ul style="list-style-type: none"> Comparable in effectiveness to PSC#1 Construction period risks on the larger Project scope mitigated by the inclusion of private sector financing / security package Operational period risk management comparable to PSC#1-2 due to the public sector's retention of scope 	<p>✓✓1/2</p> <ul style="list-style-type: none"> Key interdependent construction period risks combined in one single contract Construction period risks mitigated by the inclusion of private sector financing / security package All operations and maintenance scope is retained by the public sector Operational period risk management comparable to PSC#1-2 and SB#1 due to the public sector's retention of scope 	<p>✓✓1/2</p> <ul style="list-style-type: none"> Construction period risk management comparable to SB#2 Integration of a maintenance contractor with the DB contractor will result in efficiencies and optimization, particularly in the context of a performance specification and payment deduction regime Model also will facilitate integration of the contractor's maintenance best practices from other projects and jurisdictions Operation, vehicle & track maintenance and ridership risks are retained by the public sector As the "M" does not include the full asset maintenance scope, only a limited maintenance and asset lifecycle costs risk can potentially be transferred Most asset lifecycle exceeds the intended maintenance period, limiting the "M" to provide security against patent defect risk, which in itself has limited exposure after the warranty period Potential for interface issues resulting from maintenance responsibilities being provided by the private partner while operation activities provided by the public sector Interference of maintenance activities by the public sector operations could limit the ability to transfer the risk as intended. On balance SB#3 not more favourable as SB#2
<p>Competition, providing innovation and efficiencies, is maximized <i>Ensure an attractive, marketable and bankable transaction that brings innovation, efficiencies and value to taxpayers.</i></p>	<p>✓</p> <ul style="list-style-type: none"> Comparable in effectiveness to PSC#1. 	<p>✓</p> <ul style="list-style-type: none"> Some potential for innovation and efficiency through integration of all construction elements into a single package. Highly competitive P3 procurement process, involving CCMs/RFIs across three short-listed contractors, may facilitate greater innovation 	<p>✓✓</p> <ul style="list-style-type: none"> Comparable to SB#2 with respect to construction period innovation and efficiency Inclusion of tunnel and station maintained and rehabilitations scope maximises optimization of these assets from a whole-of-life maintenance perspective, facilitates innovation, though exclusion of operations scope puts limitations on innovation and efficiencies given the interface created
<p>Cost certainty, schedule certainty and affordability are maximized over the full life of the asset <i>Ensure that the Project is delivered on time and on budget within fiscal and cash flow constraints.</i></p>	<p>✓✓</p> <ul style="list-style-type: none"> Comparable to PSC#1, with the exception that adding private financing to major scope elements (tunnel, stations) will introduce an additional level of due diligence and oversight, 	<p>✓✓</p> <ul style="list-style-type: none"> Comparable to PSC#2, with the exception of private financing, which will introduce an additional level of due diligence and oversight, driving greater cost and schedule certainty 	<p>✓✓✓</p> <ul style="list-style-type: none"> Comparable to SB#2 with respect to the construction period costs and schedule Inclusion of long term maintained and rehabilitations obligations for the tunnel and stations will result in whole-of-life optimization of

	SB#1 – 1 DBF + 1 DB Contract	SB#2 – 1 DBF Contract	SB#3 – 1 DBFM Contract
	driving greater cost and schedule certainty for these elements, but not the overall project		these assets, and fixed price performance-based framework will facilitate cost certainty <ul style="list-style-type: none"> Operations scope retained by the public sector who will be liable for any related cost overruns (not caused by the contractor)
Ability to implement changes during the life of the Project in the most cost effective manner <i>Ensure that the implementation of changes in service levels or future capital investment in the asset can be achieved in the most cost effective and efficient manner.</i>	<p style="text-align: center;">✓✓✓</p> <ul style="list-style-type: none"> Comparable in effectiveness to PSC# 1 & 2 	<p style="text-align: center;">✓✓✓</p> <ul style="list-style-type: none"> Comparable in effectiveness to PSC# 1 & 2 	<p style="text-align: center;">✓✓</p> <ul style="list-style-type: none"> Long-term maintenance agreement could cause challenges for future flexibility to assign scope to others if the transit network is expanded The likelihood of future expansion can be accommodated for in the RFP process / Project Agreement (specifications), however there are still likely to be contractual challenges
Corridor service quality and full life asset performance are maximized <i>Ensure that the asset performs effectively during operations and that O&M services along the entire network are delivered optimally.</i>	<p style="text-align: center;">✓</p> <ul style="list-style-type: none"> Comparable in effectiveness to PSC#1 & 2 	<p style="text-align: center;">✓</p> <ul style="list-style-type: none"> Comparable in effectiveness to PSC#1 & 2 	<p style="text-align: center;">✓✓</p> <ul style="list-style-type: none"> Long term maintenance and rehabilitation asset performance / quality risk transferred to the proponent, who will be contractually and financially motivated to maximise performance and quality Operations retained by the public sector, and therefore such responsibilities will not be integrated into the development phase by the proponent and may reduce long-term asset performance and quality

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APPENDIX B – MAINTENANCE AND REHABILITATION RISK TRANSFER

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