Millennium Line Broadway Extension Project

Cost Report

March 2018

partnerships
British Columbia

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1 PURPOSE

This document details the preliminary cost estimate of the reference concept design for the Millennium Line Broadway Extension Project (the Project). The purpose of the estimate is to provide input to the Project Business Case, including risk quantification, value for money analysis, funding and procurement analyses.

2 BASIS FOR THE ESTIMATE

2.1 SCOPE OF THE WORKS

The capital cost estimate for the Project is based on a scope of work required to design, construct, and implement the Project that meets current Ministry of Transportation and Infrastructure (the Ministry) standards. The Project, located within the City of Vancouver, is an extension to the existing Millennium SkyTrain network. Commencing at the west end of the tail track to the existing Millennium Line, the alignment proceeds west as an elevated structure, turning south as a tunnel to Main Street, and thereafter west as a tunnel under Broadway for the remainder of the alignment, ending at the west end of the proposed Arbutus Station. The overall length is approximately 5.7 km, and the work includes six underground stations, a connection to the existing Canada Line station at Cambie Station (currently named Broadway-City Hall Station on the Canada Line), and all associated civil, structural and systems elements.

2.2 SCOPE OF CAPITAL COSTS

The estimate includes both the owner's and the constructor's costs necessary to implement the Project. The estimate assumes that all the work is carried out as one single project, delivered using a Design, Build, Finance (DBF) procurement model, and covers Project costs including:

- Project management;
- Preliminary design and technical investigations;
- Engagement and consultation;
- Procurement;
- Detailed design;
- Construction;
- Risk and contingencies; and
- Interest during construction.

2.3 DUE DILIGENCE REVIEW OF THE ESTIMATE

A due diligence review of the capital cost estimate was conducted, which confirmed that the budget currently carried is reasonable to design, construct and commissioning of the approximately 5.7 km extension to the existing Millennium Line SkyTrain network.

3 PROCESS AND METHODOLOGY

3.1 KEY ASSUMPTIONS

The capital cost estimate was developed based on preliminary drawings, analysis and reports, as well as input and assumptions from subject-matter experts across multiple disciplines.

The estimates have been prepared with the use of historical knowledge and current pricing levels, together with the critical elements of the work being priced from base principles, to take onto account the unique constructability issues.

The estimate covers all costs associated with the implementation of the Project from the period commencing with the set up of the owner's management team until the transit system is ready for revenue service.

The construction, design and management costs included in the estimate assume a Project schedule as follows:

- Issue RFQ fall 2018;
- Issue RFP winter 2018/2019;
- Financial Close winter 2019/2020; and
- Project entering revenue service in 2025.

Risk values and timing, retained by the owner and transferred to the contractor, are calculated as set out in the *Risk Report*. Risk values are reflected as a portion of overall contingencies. Therefore, Project contingency values, apportioned to each of the contractor and the owner, are risk-adjusted values.

The contractor's estimated interest during construction (IDC) is calculated as (1) the interest accrued on the amount of private financing amount calculated using an annual interest rate of 3.64%, plus (2) the up-front arrangement fee, minus (3) interest earned on the drawn but unspent private financing. The owner's IDC is estimated by the Ministry.

3.2 PROJECT ELEMENTS

The Project components are assumed to include the elements detailed below.

3.2.1 Utility Relocations

The estimate has quantified the current utility information, based on studies carried out by the project utilities group. An allowance is included to cover issues that remain unknown. Much of the utility relocation work occurs around the stations and includes for temporary replacement and reinstatement of existing utilities required to construct and remove the temporary traffic decks.

3.2.2 Roadworks

The roadworks cost estimate covers reconstruction of the roads disturbed by the work including:

- Temporary diversions;
- Traffic management necessary to construct the project; and
- Repairs of streets where damaged by the work.

3.2.3 Site Preparation

For site preparations, a series of allowances covering work to prepare the site and take into account the report prepared on work to existing structures and road widening. The work includes:

- Demolition costs (included as an allowance);
- Ground improvement;
- Creation and removal of lay-down areas; and
- The costs of temporarily replacing the Coast Mountain trolley bus service with a hybrid bus service to facilitate station construction activities.

3.2.4 Landscaping and Environmental Mitigation

A general allowance for environmental mitigation and landscaping along the guideway including:

- Contaminated material removal;
- Habitat compensation;
- Work to fish bearing and other sensitive issues related to water-ways and streams; and
- Hard and soft landscaping at each station entrance.

3.2.5 Tunnel, Guideway, and Station Box Excavation

This describes the structure needed to support and operate the running system which includes the civil works as set out below together with all necessary traffic management required to carry out the works.

The elevated guideway, consisting of a single two track guideway beam, is supported on columns which are supported by deep foundations. The elevated guideway ties into the existing Millennium Line guideway west of VCC-Clark station and extends to the east end of Great Northern Way station before transitioning underground.

A pair of bored tunnels is to be constructed between station structures from the south end of Great Northern Way, and continues to the east face of the Arbutus Station cross-over structure. The estimate assumes two tunnel boring machines will be used to complete the tunnel work. The tunnels include cross passages between the tunnels, and track crossroads east and west of Cambie station.

At station locations, the crossover structures east of Arbutus Station, and the tail track west of Arbutus station, bottom-up construction with temporary traffic decking will be utilized. The structures are all covered with a temporary traffic deck to allow full traffic flow during the day with partially restricted traffic flow at night.

3.2.6 Systems Structures

Structures to accommodate the systems including:

- Three enclosures for the automatic assured receptivity units with architecturally enhanced enclosures; and
- Sub-stations are included within the underground stations.

3.2.7 Stations

All stations are underground and constructed with traffic decking as noted above. The stations sizes and configurations are included in the estimate as follows:

All station boxes are between 106 and 143 metres long, with 80-metre long platforms, and include a single entry from surface level, except for Cambie Station, which is accessed from the existing Canada Line Broadway station concourse.

Minor works are included to make changes to the existing VCC-Clark Station, as it is no longer a terminus station.

3.2.8 Station Facilities

Facilities associated with the stations including the following:

- Miscellaneous furniture;
- Passenger pick-up and drop off area at each station;
- Station plazas at each station entrance;
- Public art based on an allowance; and
- Wayfinding signs to the stations.

3.2.9 Vehicle Maintenance and Storage Facility Upgrades

This is excluded from the estimate.

3.2.10 Trackwork

The estimate assumes a continuously welded mainline rail. The rail is directly fixed to elevated, structures and on plinths in tunnel guideway structures. Resilient sound absorbing track fasteners are included in the tunnel.

Provision of switches to two sets of crossovers and an end of line tail track.

3.2.11 LIM Rail

The Linear Induction Motor rail required to operate the vehicle transit technology currently in use.

3.2.12 Power Distribution

- A third and fourth rail power rail parallel to the track;
- Traction power sub-station equipment consisting of three sub-stations to the main line;
- Additional power up-grades to the existing B.C. Hydro power supply;
- LV power distribution cables; and
- Emergency power.

3.2.13 Train Control and Signalling

An automated driverless system is based upon that similar in use on the existing Skytrain transit lines. The estimate includes:

- A new vehicle control centre unit;
- Expansion of the switch control equipment;
- System management centre and vehicle control centre up-grades; and
- Customization of the new system to work with the existing system.

Interim head-end systems equipment to serve train control, communications, safety and security equipment are included to insure the project systems can function.

3.2.14 Communication and Controls

The estimate includes:

- ATC loop cables;
- Operations and maintenance radio system, including radiax cable to tunnels;
- Telephone system;
- S.C.A.D.A. equipment to stations and substations;
- Up-grades to the existing CCTV, P.A., Dynamic signage, and TVM systems central controls to accommodate the new system; and
- Integrated alarm notification system.

3.2.15 Station Security and Emergency Power

The estimate includes:

- UPS systems to stations;
- Station guideway passenger intrusion monitoring systems;
- Guideway passenger intrusion monitoring systems;
- CCTV Cameras;
- Public address system;
- Dynamic signage; and
- Emergency phones.

3.2.16 Fare Collection

A fare collection system comprising of a continuation of the “Compass” fare collection and control system currently being implemented on the existing transit lines. As Cambie Station is connected into the existing Canada Line no additional fare gates are added to this station, all other equipment is included in this station to accommodate the increase in ridership.

3.2.17 Testing and Commissioning

Testing and commissioning the complete system, including the power supply required for testing.

3.2.18 Property

Cost for property purchase requirements is included.

3.2.19 Management, Design and Engineering

Project management services for the project are required to cover all engineering and design prior to procurement, general management by project staff, and consultants for the duration of the project. This will include overall management, planning, procurement, systems integration, cost and schedule control, estimating, quality assurance, environmental control, offices, and operational costs. The estimate is based upon a detailed resource based estimate covering all management, procurement, design and engineering functions carried by, or for and on behalf of the Ministry.

Construction management services during the construction stage of the Project include: overall management carried out by the design build contractor and completing the design of the complete system by the design build contractor, including architectural, civil and system works. The work also includes general supervision and co-ordination, contract management, safety monitoring, environmental monitoring, general administration, and offices for site-based staff. Much of the direct construction management costs are included within the estimates for each major element of the work, such as stations, tunnels, and systems.

3.2.20 Vehicles

Vehicles are not accounted for in the estimate. TransLink will procure vehicles under a separate procurement.

3.2.21 Public Consultation

Community relations include public notifications, public information events and open houses, press liaison, and publications.

3.2.22 Insurance and Bonding

The estimate includes overall Project insurance and bonding covering all construction and professional liability insurance together with bonding.

3.2.23 Project Co Overhead Contribution and Profit

The estimate includes the general contractor's head office overhead contribution and profit. Sub-contractor's overhead and profit allowances are also included.

3.2.24 Procurement

The estimate includes procurement and legal work necessary to procure the Project as a DBF.

3.2.25 Independent Engineer

The services of an independent engineer are required to monitor and certify payment to the contractor, and to certify Project completion.

3.2.26 Contingencies

An allowance for specific contingencies has been set against each element of work dependent upon design development and risk to cover risks and contingency events, associated with alignment refinement, design development, unforeseen ground conditions, utilities, co-ordination with third parties, commercial risk, procurement and tendering risk, contract reserve during construction, and schedule risk, in particular the schedule risk.

4 CAPITAL COST ESTIMATE

The total estimated nominal Project cost is $2,826 million. Of this amount, the DBF contract is expected to be valued at approximately [redacted], while owner's project management, technical program, environmental and consultation process, and procurement are estimated at approximately [redacted]. Capital costs are summarized in Table 1.

Table 1 – Project Cost Estimate Summary (Nominal Dollars)

Cost Estimate Detail	Total	Contractor Costs	Owner Costs
Utilities	[redacted]		
Site Preparation			
Roadworks			
Tunnel			
Guideway			
Systems Structures			
VCC Station			
Great Northern Way Station			
Main Street Station			
Cambie Station			
Oak Street Station			
Granville Station			
Arbutus Station			
Landscaping			
Environmental			
Trackwork and LIM Rail			
Systems			
Testing and Commissioning			
Contractor's Design			
Project Management			
Contractors Consortium Management			
Property			
COV Property			
Public Consultation			
Insurance			
Operational Readiness			
Interest During Construction			
Warranty Holdback			
Bid Development and SPV Costs			
Contingencies			
BC Hydro Early Works			
Total Cost Estimate*	2,826,458,192	[redacted]	

Cash flow expectations during planning, procurement and implementation of the Project are summarized in Table 2. These estimates highlight anticipated non-eligible costs on an annual basis by fiscal year ending March 31. Risk adjusted contingencies are shown to accrue through construction and be reconciled toward the end of the construction period. This presentation is consistent with experience on prior projects. Transferred and retained risk values are also summarized.

Table 2 – Project Cash Flow Summary (Nominal Dollars)

Cash Flow (FY ending March 31)	Total Nominal	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25
Contractor Costs	[redacted]									
Risk Adjusted Contingency (Contractor)										
Bid Development and SPV Costs										
Interest During Construction (Contractor)										
Sub-total Contractor										
Owner Costs (including Insurance)										
Risk Adjusted Contingency (Owner)										
Non-eligible Costs (including IDC)										
PTIF Costs (BC Hydro Early Works)										
Sub-total Owner										
Total Cost Estimate*	2,826,458,192	[redacted]								

*Capital budget does not include expensed planning costs of [redacted] that were incurred during 2016/17 and 2017/18 prior to Provincial project approval.