Surrey Langley SkyTrain Project
Business Case

Appendix B

Capital Cost Estimate

March 21, 2022

SURREY LANGLEY SKYTRAIN PROJECT

CAPITAL COST ESTIMATE

OF REFERENCE CONCEPT DESIGN (BUSINESS CASE) FOR KING GEORGE TO 203 STREET STATION IN LANGLEY CITY CENTRE

INTRODUCTION

This cost estimate is prepared based on the Interim Reference Concept Design – Design Freeze 1 ("RCD") developed in November 2021 to support the business case assessment of the Surrey Langley SkyTrain ("the Project"), which covers the provision of an extension of the Expo Line on an elevated guideway from King George Station to 203 Street Station.

This estimate takes into account information that has been made available from the preliminary engineering work being carried out. The construction is estimated to commence at the end of 2023 with target completion in the Summer of 2028.

BASIS OF ESTIMATE

1. The alignments are based upon drawings, meetings and information provided related to geotechnical findings, land use plans, utilities, and environmental information as part of the RCD developed following the province's decision to become the delivery agent for the Project upon Concept Plan approval in October 2021.

2. The estimates have been prepared based on the Project scope as defined in the RCD drawings, corresponding quantities, and schedule, with consideration of labour, materials, equipment costs, and productivity in a detailed Project analysis and adjustment of historic unit rates to accurately reflect the Project specific constraints and current market force.

3. The estimates are to cover all costs associated with the implementation of the Project from the period with confirmation of funding approval until the transit system is ready for revenue service.

4. The Project is assumed to be delivered by Transportation Investment Corporation ("TI Corp") to completion.

5. The route length is approximately 16 kilometers consisting of fully elevated guideway from King George Station to 203 Street in Langley City Centre.

6. All stations are above ground with 82.5 meters long station platforms, whilst the vehicle storage tracks along the mainline are designed to accommodate 86.5 meters long trainset in line with the latest SkyTrain fleet requirements.

7. The construction prices are assuming the use of pricing obtained from competitive tenders, with some exceptions such as exclusive and proprietary services/products for system integration and compatibility. The construction prices are estimated based on minimal restrictions on construction methodology and without contractual conditions that would create onerous contractual situations that would be reflected in a contract price.

8. The management for the Project is anticipated to be broken out into multiple project management groups, similar to that carried out to implement the Millennium Line.

9. The estimate assumes three contract packages for the Multiple Contract Procurement model. Contract Package 1 encapsulates the Guideway construction including utility relocations, roadworks, and the guideway foundations, substructure, and superstructure. Contract Package 2 includes construction of the eight stations and PPS structures (station PPS and standalone). Contract Package 3 includes the trackwork & LIM rail, systems, and testing & commissioning.

10. The construction, design and management costs included in the estimate assume the project management and procurement commencing in late-2022, with the Project entering revenue service in the summer of 2028, and includes inflation over the construction period. The inflation levels assumed in the Project are provided by Infrastructure British Columbia ("IBC") and Deloitte Touche Tohmatsu Ltd. ("Deloitte"), based upon the following yearly escalation:

Element	Prior to Contract Award	During Construction
Systems, Civil and Building Works	2.8% per annum	Increasing from 3.0% per annum in 2024 to 3.5% per annum in 2026 and beyond

11. The estimate is based upon an opinion of cost that creates a preliminary estimate with assumptions and allowances covering work that cannot be quantified, which will need to be reviewed as the Project becomes more clearly defined and adjusted as necessary to reflect any changes in scope and levels of pricing.

12. The estimates excludes the following:

a) Financing costs beyond the construction period.
b) Street works beyond the transit routes.
c) Temporary property acquisition costs, beyond that required for construction.
d) Studies prior to Project commencement.
e) Post construction streetscaping.
f) Spares necessary for operations, except for vehicles.
g) Operating costs.
h) Past costs incurred by TransLink and other key stake holders for the previous LRT project.
i) Project development costs incurred by TransLink and other key stake holders during initial development with TransLink as the delivery agent.
j) Future tariffs which are unknown as of to date.
k) GST.

13. The current proposal to construct this Project is primarily using precast concrete segments with installation by overhead gantry launching method where site condition permits for elevated guideway and long-span steel box girder segments where site constraints limit the substructure locations to maintain the existing infrastructure or roadwork. Similar construction methods had been used in previous SkyTrain projects, such as Millennium Line and Evergreen Line Extension. As engineering and design is developed these estimated costs need to be closely monitored, and perhaps increased or decreased as further information becomes available.

PRELIMINARY CAPITAL COST ESTIMATES

The following table summarizes the preliminary capital cost estimates for the SLS Project (from King George to Langley City Centre), in as-spent dollars, based on the envisaged Project schedule:

Capital Cost Category	Cost (in Millions, Nominal $)
Contractor's Construction Cost	[redacted]
Design and Construction	[redacted]
Contractor IDC	[redacted]
Transferred Risks	[redacted]
Owner's Cost	[redacted]
Project Management and Staff Costs, Vehicles, TransLink support, and other costs	[redacted]
Property acquisition	[redacted]
Advance Works	128
Retained Risks and Contingencies	[redacted]
Provincial IDC	[redacted]
Total	3,939

[1] Total Capital Cost of $3,939 million plus planning costs (Operating Expense) of $11 million, for a total Project related cost of $3,950 million.

The above cost estimate is a class "3" Project Cost Estimates (-20% to +30%) per the Ministry of Transportation of Infrastructure "Project Cost Estimating Guidelines" December 2020.

SCOPE OF THE WORKS

1. Site Establishment

The site establishment for the Project consists of the nonrecoverable costs required to establish temporary facilities needed to support the works onsite. The estimate for site establishment includes site offices, telecommunications systems, site utilities, office equipment including computers, survey equipment, hoarding and security, transportation, plant in and out, and permitting.

2. Utility Relocations

The estimate has quantified the current utility information, based on studies carried out during the RCD. In order to account for issues that remain unknown with respect to utility relocation, the Project team has included this item as a shared risk between TI Corp, and the Contractor. In doing so, a portion of this risk is captured in the Capital Cost Estimate (transferred portion), as well as the Project Risk Reserve (retained portion). The estimate for utilities includes relocation of deep utility, shallow utility, street lighting upgrades, and all associated trenching and roadworks where applicable.

3. Roadworks

The roadworks cover road modification along the track alignment, upgrades to existing infrastructure such as medians and delta islands affected by the guideway piers, paving and flatwork associated with transit exchanges and stations as well as other roadwork reinstatement within the Project corridor. The estimate for roadworks includes work to existing infrastructure, traffic management, earthworks (excavation and fill) and access preparation, paving, medians and islands, flatwork, boulevard, and tree clearing and replacement.

In addition, there will be significant roadways works required for the various pick-up/drop-off locations and bus transit facilities, including the myriad of sidewalk and other pedestrian and bike-oriented improvements to provide safe and reliable public access to all SkyTrain amenities.

4. Elevated Guideway

The guideway for the Project consists of 16 kilometers of elevated guideway constructed primarily of precast concrete segments with five long span steel box girder segments and associated substructure. The estimate of guideway includes the drilled shafts (generally 2.40-meter to 2.75-meter diameter at 14.8-meters to 50.0-meters deep), driven steel piles in areas of weaker soils (up to depths of 100.0-metres deep in the ALR portion), pile caps, piers, pier caps, precast superstructure, steel superstructure, noise barriers, overhead gantry acquisition and storage costs, modifications to the tail track at King George Station, and building demolition along the alignment to facilitate guideway construction. At some critical sections with site constraints, alternative construction methods in lieu of overhead gantry for the guideway construction is assumed.

5. Systems

The systems for the Project consist of the system elements for propulsion power substations (PPS), SkyTrain station fit outs, guideway system elements, power rail, and automatic train control ("ATC") requirements. The estimate for systems includes BC Hydro connection costing, duct bank installation including switchgears and vaults, station fit outs including electrical and mechanical, PPS system components, uninterrupted power sources ("UPS") and lights, power rail, and ATC components. System components include:

- An AARU is included for each of the ten PPS of the Project to maintain 100% receptivity of the propulsion power rail distribution system.
- Supervisory control and data acquisition system ("SCADA").
- Protection and grounding system.
- AC / DC switchgears.
- PPS batteries.
- Dual voltage transformer-rectifiers.
- Station service transformer monitored by the SCADA system.
- Uninterruptible power supply system.
- Blue light system.
- AC / DC power cables.

These system components are to ensure that the Project's propulsion power system maintain operation in situations of power or system failures and be capable of supporting a sustained operation of AW2 loaded five car trains. The system will be universally accessible.

6. Stations

The Project consists of eight stations and their associated onsite and offsite work. All stations are above-ground. The estimate for stations includes site preparation, lot grading, station structure costs, station finishes and fit outs excluding systems and guideway elements, and public artwork. The stations sizes and configurations are included in the estimate as follows:

All stations are of a platform length of 82.5 meters and a width of 3.0 meters or greater. The stations will include a single entry from surface level.

The stations include the following:

- Platforms with width of 3.0 meter or greater.
- Ground concourse level.
- Mezzanine for 140 and 160 Street Stations.
- Station entry plazas and service parking for operational staff.
- Station finishes in keeping with finishes on Expo Line.
- Full canopy coverage.

- Escalators per America Public Transportation Association ("APTA") standard and glazed elevators as follows:

	Station	Number of Escalators	Number of Elevators
King George to Langley City Centre	140 Street	8	3
	152 Street	4	2
	16 Street	6	3
	166 Street	4	2
	184 Street	4	2
	190 Street	4	2
	196 Street	4	2
	203 Street	3	1

- Furniture, including seating, notice board, cabinet, and garbage receptacles.
- Signage public address and external landscaping.
- Guideway Intrusion Monitoring System (GIMS).
- Service connections to the stations.
- Ancillary rooms at ground level.

7. Station Facilities

Facilities associated with the stations including the following:

- Furniture to be defined including trash cans, seating etc.
- Passenger pick-up and drop off area at each station.
- Station plazas at each station entrance.
- Wayfinding signage for the SkyTrain network and public address.
- Real-time passenger information displays and transit information.
- Bike parking.
- Emergency egress stairs and emergency phones.

- Benches and other accessibility facilities.

8. Trackwork & LIM Rail

The guideway will be fully elevated with two parallel tracks for separation of inbound (westbound) and outbound (eastbound) trains between and through all stations. The track type will be direct fixation on elevated structure with derailment protection and the running rail is standard 115RE with head hardened.

The track geometry will be a functional design for SkyTrain operations and follow the SkyTrain RTP 2000 Design Manual.

"Special trackwork" comprises of switches between inbound and outbound tracks, sidetracks, and crossover tracks for operational and emergency use.

The estimate for trackwork and Linear Induction Motor ("LIM") rail includes running rail, LIM rail, coverboard, fall-arrest rail, walkways, cast in place concrete work, turnouts, and special trackwork. The LIM rail required to operate the vehicle transit technology currently in use, consisting of a laminated black steel back iron with an aluminum cap.

9. Power Propulsion Distribution System

The Project includes 7 station Power Propulsion Systems and 3 stand alone Power Propulsion Systems. All PPSs shall be minimum 2 MW and upgradable to 4 MW by the addition of a transformer-rectifier and associated switchgear only.

The PPSs located at stations include a 500kVA station service transformer.

The power factor for each PPS shall be at least 0.95 lagging when averaged over any 24 h period.

The system shall include two UPS units at each station AC electrical room ("ACER") to provide 2 hours of back-up power. The UPS shall be powered from the incoming BC Hydro supply or from a BCRTC mobile generator.

The power distribution will be in coordination with BC Hydro. The proposed BC Hydro PPS connection provides an alternating PPS feed from independent circuit utility feeds.

10. Train Control and Signaling

The Project will extend the existing SkyTrain system ATC to 203 St Station forming an integrated part of the Expo Line. A moving block driverless system is based upon that similar in use on the existing SkyTrain network. The extended portion of the train control and signaling will be customized to work with the existing system. The Vehicle On-Board Computers are included with the vehicles, as these are to be supplied with the vehicles and the associated costs are included in the vehicle costs.

11. Communication and Controls

The Project will include the following communication components:

- Fibre Optic Communication System and any associated work connecting to the OMC1.
- SkyTrain radio communications.
- Train Radio Information Management System.
- Telephone communication.
- Video surveillance.
- Passenger information displays.
- Ethernet communications.

12. Station Security and Emergency Power

For station security, all Project stations will include a Track Intrusion Detection System ("TIDS") to monitor normal operation of the train and triggers notifications to staff and passengers in case of an intrusion.

In addition, station emergency stop buttons will be included as a mean to stop automatic train operation in vicinity of station platforms. The emergency buttons shall interface with Project's ATC system of the Project.

Furthermore, the Project shall include an Underwriters Laboratories of Canada (ULC) listed Fire and Life Safety System ("FLSS") to monitor and control fire and life safety equipment, emergency public address and emergency telephones in each station and PPS. FLSS will also supervises linear heat detection systems at locations where the guideway is located within 3.0 meters of or directly above existing buildings.

13. Drainage

The drainage for the Project consists of drainage infrastructure necessary to achieve 1:5-year post-development flow rates no greater than the current 1:5-year pre-development flow rates. The estimate for drainage includes high-density polyethylene (HDPE) pipe, manholes, catch basins and lawn basins, earthen swales, splash pads, underground storage tanks, stormceptors, headwalls, and oil grit separators.

14. Testing and Commissioning

The testing and commissioning phase of the Project is estimated to commence in the summer of 2027 for duration of approximately one year to ensure functional SkyTrain operation before entering revenue service. The estimate for testing and commissioning includes costs incurred by the Contractor for site installation tests, site acceptance tests, and overall Project performance tests.

15. Environmental & Agriculture, Landscaping, Archaeology & First Nations

A general allowance for environmental and agriculture, landscaping, archaeology, and First Nations cost items, which may include:

Environmental and agriculture

- Additional measures to address perceived noise increases at sensitive receptor locations.
- Treatment of contaminated materials.
- Noise, air, and water monitoring during the Project.
- Requirements for abatement, remediation, and disposal of contaminated materials during demolition activities.
- Potential offsetting requirements following impact assessment at watercourse locations and in Green Timbers.

Landscaping

- Upgrades to existing bus shelters or provisions for additional bus shelters along the alignment.
- Community enhancements along the alignment and at station locations including boulevard upgrades.
- Architectural enhancement lighting.
- Berms and/or visual screening at impacted property boundaries.

Archaeology and First Nations

- A provision for procurement opportunities within the Project.
- First Nations Capacity Fund contributions.
- First Nations Impact Benefit Agreements.
- Archaeological monitoring.
- Planning and obtaining permits with the Archaeology Branch.
- A provision for an archaeologist.

Key areas of concern for the Project include the Green Timbers. The Green Timbers is a sensitive natural habitat which will require care and caution while working. Trees will not be permitted for removal without explicit approval and care must be taken to prevent damage to any trees that will remain after the construction.

16. Special Purpose Vehicle Costs

The special purpose vehicle (SPV) costs for the Project are costs associated with establishing an SPV for the Project. The estimate for SPV costs includes costs, incurred by Project Co, to develop, maintain, and terminate the SPV.

17. Bid Development Costs

The bid development costs for the Project consists of the nonrecoverable costs to provide the technical and financial submissions for the Project. The estimate for bid development costs includes bid development related expenses, incurred by Project Co, to complete the procurement process for the Project.

18. Insurance and Bonding

Overall Project insurance and bonding covering all construction and professional liability insurance together with bonding taken as [redacted] of total direct and indirect construction costs and insurance taken as [redacted] of total direct and indirect construction costs.

19. CBA Labour Charge Allowance

The CBA labour charge allowance for the Project consists of the labour uplift anticipated due to the Project being subject to the provincial community benefits agreement (CBA). The estimate for the CBA labour charge allowance includes a percentage increase to direct construction items requiring a labour component.

20. Transferred Risk Contingency

The transferred risk contingency for the Project consists of risk items identified in the risk register and quantified through Monte Carlo analysis and transferred to Project Co through Project Agreement (PA) language. The transferred risks have been quantified using Monte Carlo simulation by IBC and Deloitte, with input from TI Corp and their advisors and the nominal risk value under a Multiple Contract model have been quantified to be [redacted].

21. Contractor Interest During Construction

The contractor interest during construction for the Project consists of interest incurred by the contractor through moneys borrowed to complete construction of the Project. The estimate for interest during construction includes the interest incurred over the course of project construction.

22. Monthly Escalation Correction

The monthly escalation correct for the Project consists of the monthly escalation adjustment represented by the increase in granularity of escalation calculations completed by Deloitte based on a monthly compounding period.

23. Construction Management, Design, Project Management, and Engineering

The construction management for the Project consists of the staffing costs to manage the construction of the Project. The estimate for construction management includes staffing costs for nonproduction personnel, required by the Contractor to complete the Project. The estimate is based on typical salaries and staffing requirements for projects of this scale.

Design of the complete system, including architectural, civil and system works both prior to construction commencing and providing design support through construction. The estimate for design includes design related expenses incurred by the Contractor to complete the Project. The estimate is based upon an allowance of [redacted] of all total direct construction costs.

Upon the province's decision for TI Corp to become the delivery agent for the Project, TI Corp is the responsible party for Project Management. Project Management services for the Project covers the general management by project staff and consultants for the duration of the Project. This includes overall management, planning, procurement, systems integration, cost, and schedule control, estimating, quality assurance, environmental control, and operational costs. The estimate is based upon typical salaries and staffing requirements for projects of this scale. Project management includes:

- Procurement costs to award the design build contract.
- Legal costs.
- Independent engineering services to monitor payment for funding purposes.
- Environmental permitting and First Nations engagement.
- Public communications and consultation.
- Finance and accounting over the Project implementation, including accounts payable, financial control and management accounting.
- The provision of security to the system between completion of construction and opening.
- Planning of operations including general planning and training prior to opening.
- Community relations including publicity, press liaison, publications, and public information events and open houses.

Engineering Services include typical engineering costs for large public works projects. These services include technical advising, independent engineering certification, geotechnical and seismic engineering, traffic engineering, and engineering support and studies.

24. BCIB Framework

The BCIB Framework for the Project consists of the BCIB management framework costs anticipated due to the Project being subject to the CBA. The estimate for the BCIB framework includes a percentage increase to direct construction labour costs for the Project to account for the management effort required.

25. Bidder Stipend

The bidder stipend for the Project consists of a stipulated fee paid to unsuccessful proponents in design-build procurements. The estimate for bidder stipend includes the payment of two honorariums to the unsuccessful, shortlisted proponents as payment for work completed in the preparation of their proposals.

26. Public Art

The public art for the Project consists of a budget allowance to develop a project-specific public art plan for the Project. The estimate for public art includes a public art budget that complies with TransLink's Public Art Policy (November 15, 2018).

27. OMC 5 Project Contribution

The new vehicles (total [redacted] cars) for the Project will be maintained at a new Operations and Maintenance Centre 5 (OMC 5) under planning along the SLS extension. The current cost allowance for contributing to the additional OMC 5 infrastructure works required for the Project is estimated based on the additional storage and maintenance capacity required to accommodate the new vehicles at the OMC 5.

28. Concept Plan/Business Case Development Costs

The concept plan / business case development costs are TI Corp's costs to develop the reference concept design and business case proposal to ascertain funding for the Project. These are the agreed numbers from the October 2021 Concept Plan that form part of the overall project budget.

29. Advanced Works

The advanced works for the Project consist of costs for construction works pulled out of Project Co's scope to be completed as advanced works. The estimates for advanced works include BC Hydro Transmission line relocations, BC Hydro Distribution & Telecoms relocations, a portion of design for the BC Hydro Propulsion Power Supply, a pile load test in the Serpentine Valley, CoS delivered 4-laning of Fraser Highway through Green Timbers, relocation of a Jim Pattison digital ad sign, funding contribution for early First Nations engagement, funding contribution for the fibre optic retrofit works from OMC1 to King George, funding contribution for early property acquisitions, and funding contribution to implement CENELEC standards on the Project.

30. Property Staff Costs

The MoTI property staff costs for the Project consist of MoTI's staffing costs required to acquire and manage the properties required by the Project. The estimate for MoTI property staffing costs includes staffing costs incurred by MoTI Real Estate to acquire permanent, temporary, and laydown lands, negotiate compensation for owners, action non-consensual agreements or expropriation, and complete appraisals.

31. Property Acquisition

Property estimates for the segment from King George to Langley City Centre are based on the RCD prepared in December 2021. The property acquisition costs include a [redacted] contingency within the property budget and assumes that the acquisition program will commence at the end of the second quarter of 2022 and continue through to the first quarter of 2024.

32. OMC 5 Property Project Contribution

The OMC 5 property project contribution consists of a project apportionment for the permanent property take required for the construction of the OMC 5 site. The estimate for OMC 5 property project contribution includes present day land value, land value escalation, compensation to owners, and additional compensation for non-consensual agreements/expropriation.

33. Laydown Areas

The laydown areas for the Project consists of temporary property takes required for the completion of the Project scope. The estimate for laydown areas includes present day land value, land value escalation, compensation to owners, and additional compensation for non-consensual agreements/expropriation.

34. TransLink Support Agreements

TransLink support agreements include all TransLink coordination costs, Operational Readiness, Transit Operations Disruptions, Compass Faregate Equipment, Transit Police Vehicle Procurement, TransLink System Modernization Program, TransLink 5-Digit ATC Track Selection Update, supply and installation of fibre optic cable from OMC 1 to King George station, CENELEC requirements, NVCC requirements, and Vehicles.

TransLink coordination costs are TransLink's incurred costs to coordinate delivery of the project now that TI Corp is the delivery agent of the Project. TransLink Coordination includes Major Projects integration, project coordination, systems integration, TransLink legal support, and design review.

The operational readiness for the Project consists of the operational readiness budgets for BC Rapid Transit Company ("BCRTC"), and Transit Police. The estimate for operational readiness includes the BCRTC staff, equipment, and resources to support the integration, construction, testing and commissioning, operational readiness of the Project and Transit Police to efficiently deploy, operate and maintain the extension to the Expo Line. These start-up costs include additional storage facilities and equipment, non-revenue vehicles, preparation and revisions to manuals and safe work procedures, and special train jacking for MK-III 5-car train sets.

Transit Operations Disruption consists of construction impact costs incurred by Coast Mountain Bus Company ("CMBC") during construction. The estimate for transit operations disruptions includes the operation and vehicle costs due to services delay to CMBC. These costs include additional service hours and vehicles required to sustain service during construction.

A fare collection system comprises of a continuation of the Compass fare collection and control system currently being implemented on the existing transit lines, which includes Compass vending machines, faregate stanchions and exit ticket machines.

The Transit Police Vehicle Procurement costs consist of the purchase of transit police vehicles to service the new extension. This includes vehicle procurement, vehicle fitout, and transit police operator uniforms.

[redacted]

Additional trains required for the Project will be 5-car equivalent. A total of 30 cars would be procured for the Project to extend to 203 Station in Langley City Centre.

35. Municipal Contributions

Municipal Contributions includes the City of Surrey parking provision, the City of Surrey property contribution, the Township of Langley contribution, and the City of Langley contribution to the project.

The City of Surrey parking provision for the Project consists of a City of Surrey (CoS) contribution toward Park-and-Ride parking spaces near station locations along the alignment.

The City of Surrey property contribution for the Project consists of a CoS contribution toward project lands as directed by the Mayor's Council. The estimate for City of Surrey land contribution includes an allowance for property transfer and/or cash transfer from CoS to the Project.

The Township of Langley (ToL) contribution for the Project consists of any municipal contributions to support the Project.

The City of Langley (CoL) contribution for the Project consists of any municipal contributions to support the Project.

36. Contingency

The estimate includes contingencies as a separate allowance which is based upon an assessment of the contingences and risk that could be attributed to any particular element of the work. This allowance on construction, design, and management acts to cover risks and contingency events, associated with alignment refinement, design development, unforeseen ground conditions, utilities, coordination with third parties, commercial risk, procurement and tendering risk, contract reserve during construction, and schedule risk. The risks have been quantified using Monte Carlo simulation by IBC and Deloitte, with input from TI Corp and their advisors and the nominal risk value under a Multiple Contract model have been quantified to be [redacted] million.

37. *Interest During Construction ("IDC")*

IDC is the financing interest on all capital expenditure over the Project implementation period and a varying borrowing rate ranging from approximately 1.93% to 2.96% is assumed.