

UBC Line Rapid Transit Alternatives Analysis

Findings to Date



March 2013

This document identifies the three alternatives that meet the long term needs of the Broadway corridor (Commercial Drive to UBC) based on the work to date from the UBC Line Rapid Transit Alternatives Analysis. TransLink will advance these alternatives for consideration in the Regional Transportation Strategy.

Background

The Broadway corridor is one of the region's busiest bus corridors, connecting Commercial-Broadway Station to the University of British Columbia. The corridor features major population, job, and institutional centres, notably Central Broadway and UBC—two of the highest patronage transit destinations in the region outside downtown Vancouver.

TransLink has been leading a multi-phase analysis to confirm the case and evaluate alternatives for rapid transit service in the Broadway corridor. Initiated in 2009, analysis has been undertaken in partnership with stakeholders including the City of Vancouver, University of British Columbia, the University Endowment Lands, Metro Vancouver and the Musqueam Indian Band. Public consultation has occurred throughout the process.

At the outset, the analysis identified the following problem statements given the transportation issues in the corridor:

1. **Capacity and Reliability:** Existing transit services in the Broadway corridor do not provide sufficient capacity or service reliability to the major regional destinations and economic hubs within the Broadway Corridor.
2. **Transit trips and mode share** need to increase to reduce vehicle kilometres travelled (VKT) and GHG and CAC emissions, both directly and by supporting the Regional Growth Strategy and other regional objectives.
3. **Affordability:** Availability of regional transportation funding and the need to balance a range of investment priorities were identified as regional problems for consideration; a single corridor analysis cannot provide the regional assessment but can provide inputs to it.

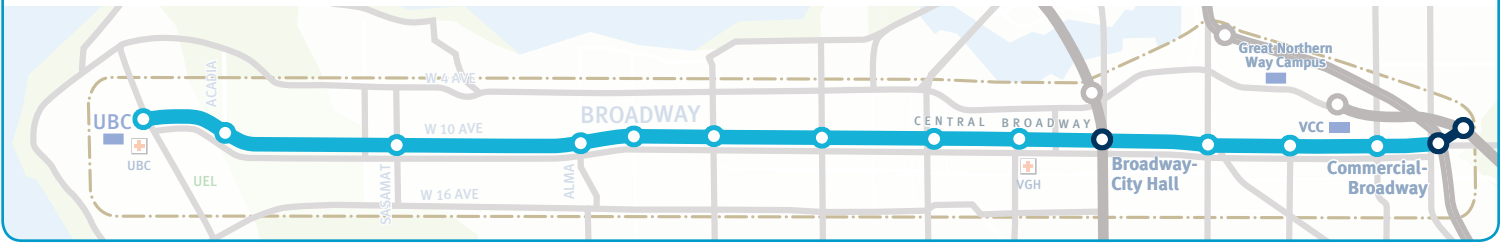
The analysis employs a Multiple Account Evaluation approach, which provides qualitative and quantitative evaluations of a wide range of factors or "accounts" to identify the benefits and impacts of each alternative.

Seven Alternatives Evaluated

Phase 1 of the analysis narrowed a list of 173 possible alternatives to six. A seventh alternative (Combo 2) was added as a result of public consultation, resulting in the seven alternatives that have been evaluated in detail in Phase 2. Each Phase 2 alternative used one or a combination of Bus Rapid Transit (BRT), Light Rail Transit (LRT) and Rail Rapid Transit (RRT/SkyTrain) technologies, as shown in Figure 1.

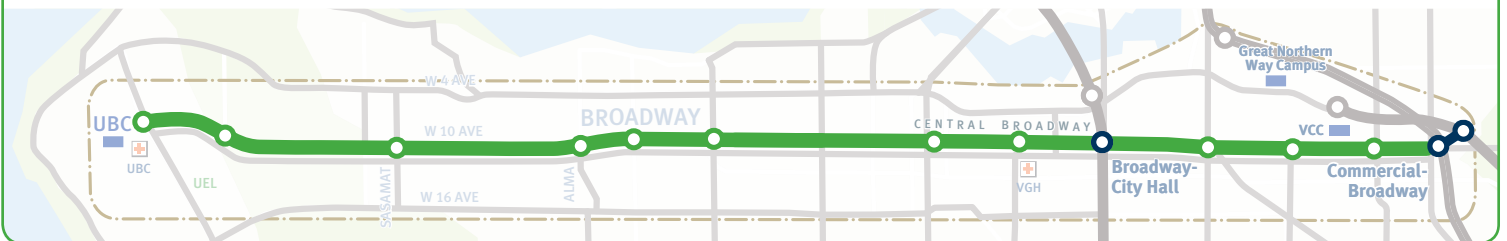
All rapid transit operates at high frequency in a dedicated guideway. BRT and LRT are assumed to operate primarily at the street-level. RRT/SkyTrain is assumed to operate primarily in a tunnel.

BRT – At-grade BRT route from Commercial-Broadway to UBC via Broadway, University Blvd and West 10th Ave using diesel articulated buses¹.

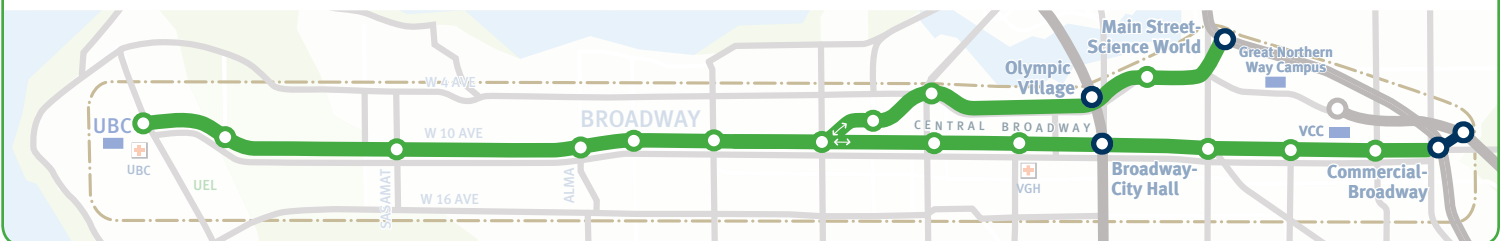


1. A trolley BRT option was also assessed as having a higher capital cost and greater environmental benefits than the diesel option. For the purposes of this evaluation, a diesel option was assumed. If BRT is pursued further, this subject could be revisited.

LRT1 – At-grade LRT route from Commercial-Broadway to UBC via Broadway, University Blvd and West 10th Ave.



LRT2 – combines LRT1 with a second branch from Main Street-Science World to Broadway/Arbutus via Station St, the City of Vancouver Streetcar route and the CPR right-of-way.



RRT (SkyTrain) – Mainly tunnelled extension of the Millennium Line SkyTrain from VCC-Clark to UBC via Great Northern Way, Broadway, West 10th Ave and University Blvd.

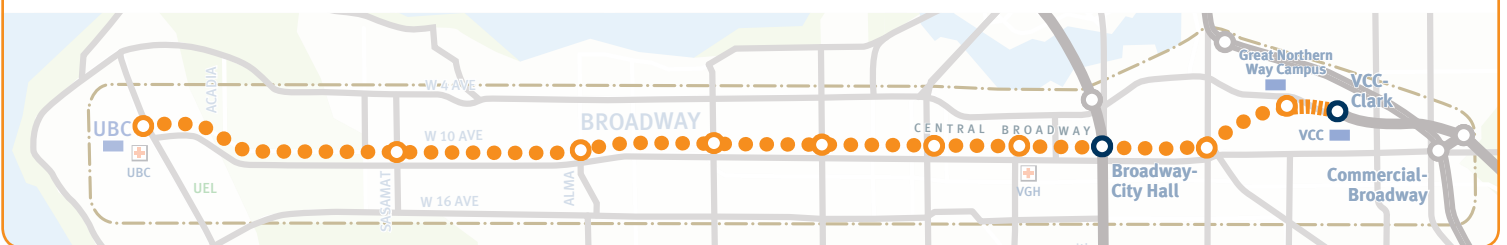


Figure 1 - UBC Line Rapid Transit Alternatives (continued on next page)
 (Key: BRT lines are blue, LRT lines are green, RRT lines are orange, Best Bus is navy)

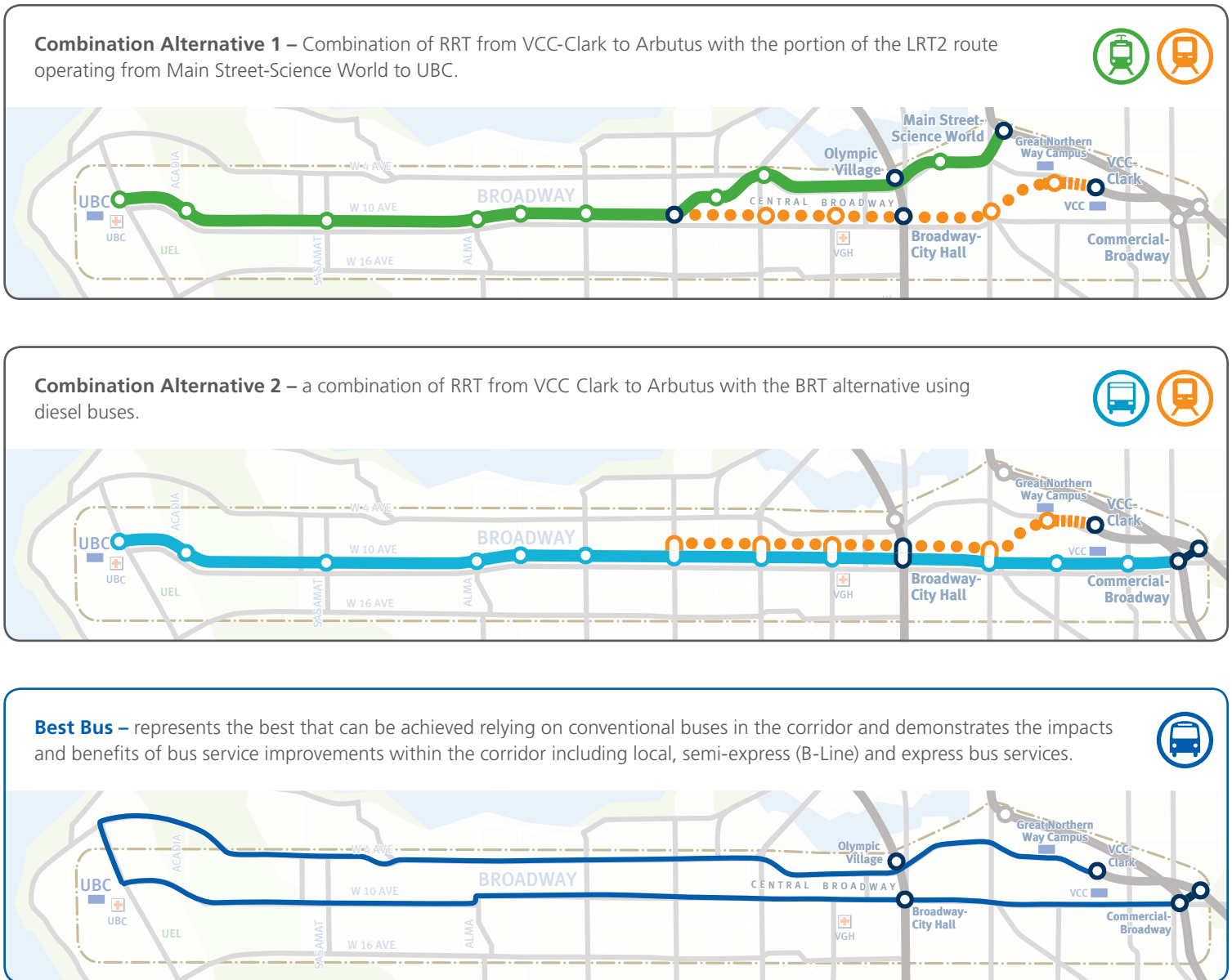


Figure 1 - UBC Line Rapid Transit Alternatives
 (Key: BRT lines are blue, LRT lines are green, RRT lines are orange, Best Bus is navy)

Results

TransLink has identified three rapid transit alternatives for the corridor that represent a range of viable options that respond to the problem statement for further consideration as part of the Regional Transportation Strategy.

The Regional Transportation Strategy, consisting of a long-term (30-year) strategy and a medium-term (15-year) implementation plan, will document the preferred multi-modal network for the region and the conditions required to support

the various investments. The strategy will also provide the technical analysis and the forum for the regional dialogue required to confirm the preferred alternative from each of the rapid transit alternatives analyses within a regional multi-modal network plan.

The following information focuses on those criteria that helped to differentiate the alternatives and demonstrate performance relative to the transportation needs of the corridor.

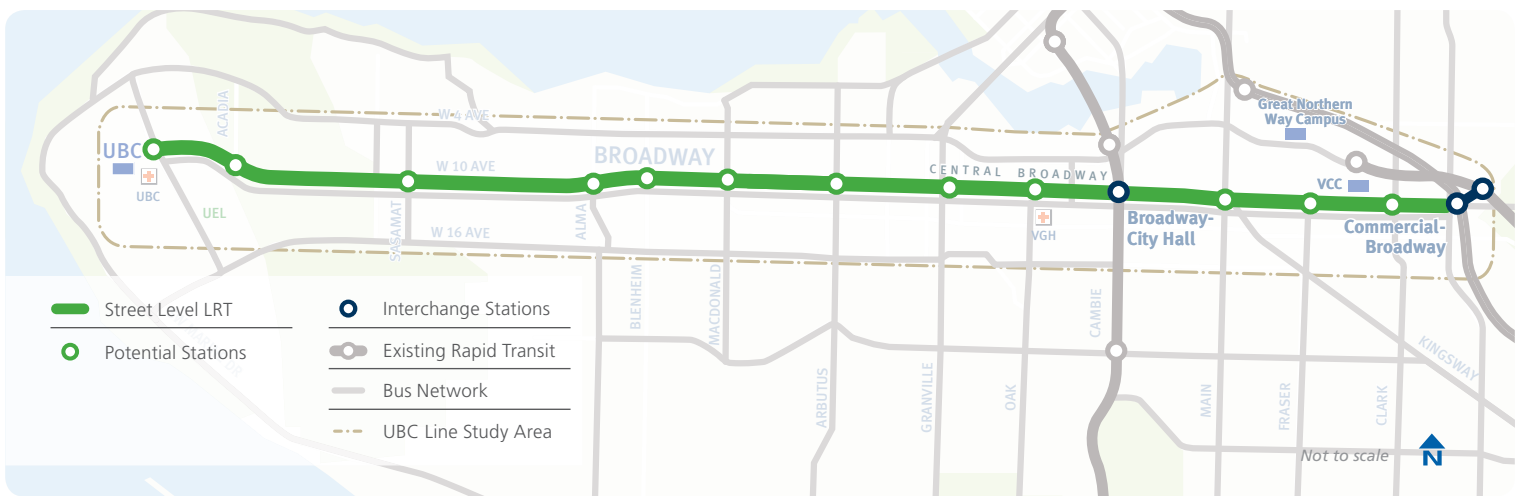
Technical Findings to Date

The technical findings to date identified three alternatives for further consideration in the regional process.

LRT Alternative 1: At-grade LRT route from Commercial/Broadway to UBC via Broadway, University Blvd and West 10th Ave.

This alternative provides sufficient capacity to meet forecast demand at the lowest lifecycle cost. It addresses the capacity and reliability problems in the corridor, providing a lesser improvement than the alternatives with RRT. LRT is projected to have 160,000 daily boardings (2041) and generate 11,000 additional daily transit trips in the region. It also generates other quantifiable benefits. It operates at street-level and therefore would have impacts associated with turning restrictions and reduced road capacity.

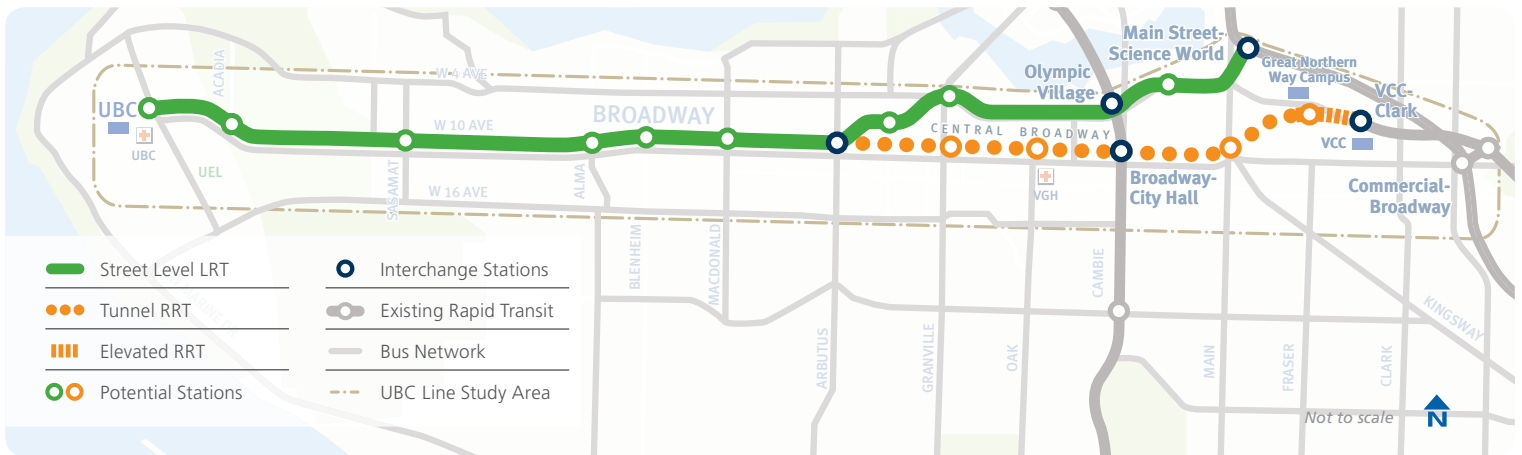
It is possible to achieve further benefits and reduce impacts through a variation on this alternative that would see part of the LRT built in a tunnel where Broadway is busiest. This partially tunnelled variation would reduce the street-level impacts and improve reliability and travel time relative to at-grade LRT. The cost and performance of this variation would vary depending on the length of the underground segment.



Combination Alternative 1: Combination of RRT from VCC-Clark to Arbutus with the portion of the LRT2 route operating from Main Street-Science World to UBC.

This alternative addresses the capacity and reliability problems in the corridor and provides the second greatest improvement at the second highest lifecycle cost. It is projected to have 350,000 daily boardings² (2041) and generate 44,000 additional daily transit trips in the region. It provides rapid transit benefits to a broader area than either RRT or LRT1 as it

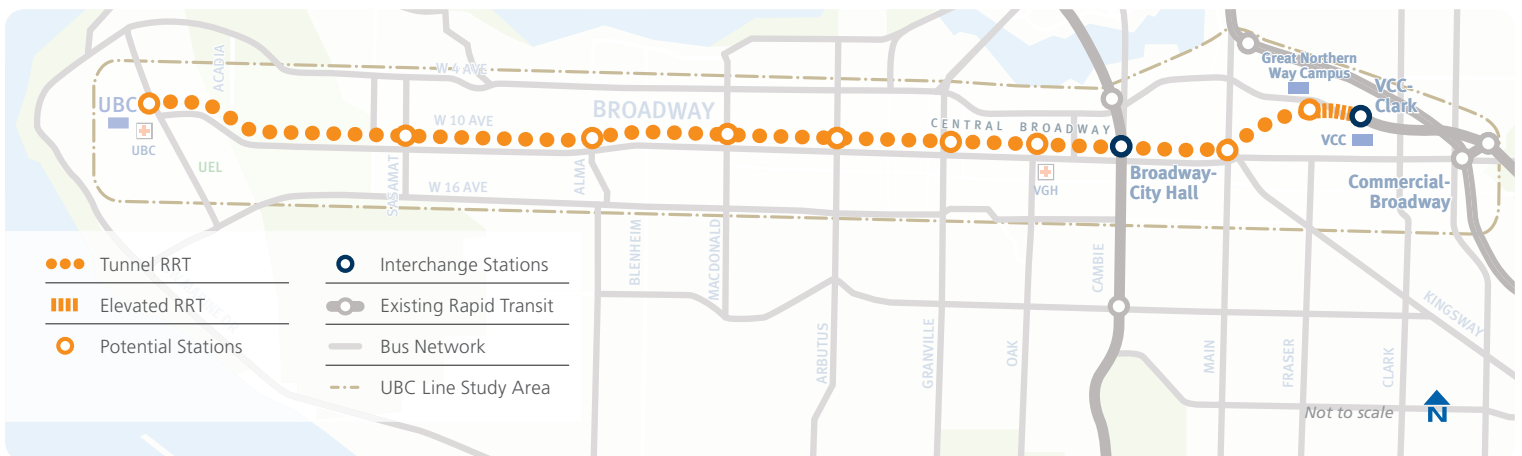
serves two routes east of Arbutus. It has the second highest ridership and provides 80 per cent of the quantifiable benefits of RRT at 85 per cent of the cost. The LRT portion operates at street-level and therefore would have impacts associated with turning restrictions and reduced road capacity.



RRT (SkyTrain) Alternative: Mainly tunnelled extension of the Millennium Line SkyTrain from VCC-Clark to UBC via Great Northern Way, Broadway, West 10th Ave and University Blvd.

This alternative addresses the capacity and reliability problems in the corridor, providing the greatest improvement at the highest lifecycle cost. It is projected to have 320,000 daily

boardings (2041) and generate 54,000 additional daily transit trips in the region³. It has the highest ridership and generates the highest quantifiable benefits.



2. Combination 1 generates the highest number of boardings since each passenger using both the RRT and LRT sections is counted as boarding twice.
 3. For context, without the UBC Line there are projected to be about 2 million daily transit trips in the region in 2041.

A comprehensive set of quantitative and qualitative criteria were considered through the analysis’s multiple account evaluation. Some quantitative attributes are summarized in the table below.

Several alternatives are not recommended for further consideration for the UBC Line corridor:

- Alternatives with bus or BRT technology (Best Bus, BRT alternative and Combination Alternative 2) do not have sufficient capacity to meet demand in 2041 (or before) and so are not long-term solutions for the corridor.
- The capacity on the northern branch of LRT2 is under-utilized, does not directly address the capacity needs on Broadway, and the additional benefits of providing that branch do not warrant the additional costs. Therefore, LRT2 is not recommended for further consideration.

Trade-Offs and Considerations

As these three identified alternatives are advanced to the Regional Transportation Strategy, the following trade-offs and considerations will need to be weighed in the selection of a preferred alternative.

ACCEPTABILITY

Given the current level of design and information, these three alternatives are more acceptable than business as usual, according to market research. The RRT alternative receives the highest acceptability rating, followed by LRT1 and Combination 1. Evaluation of potential funding implications for taxpayers or users has not been assessed. Public engagement will continue to be a part of the Regional Transportation Strategy to allow ongoing input on the acceptability of the alternatives in the context of regional needs and funding requirements.

AFFORDABILITY AND COST-EFFECTIVENESS

There is a large range in capital and lifecycle costs among the alternatives: from a \$1.1 billion capital cost for LRT1 to \$2.7 billion for Combination 1 and \$3.0 billion for RRT. RRT and Combination 1 include extensions of the Millennium Line and provide shorter travel times because RRT has no interaction with other traffic and a transfer at Commercial-Broadway Station is avoided for Millennium Line users. As a result, they generate more travel time savings and attract more riders than LRT1 and so perform better on a number of measures of cost-effectiveness (e.g. cost per new transit rider) despite their capital and lifecycle costs being over 2.5 times greater than those of LRT1.

KEY ATTRIBUTES OF THE IDENTIFIED ALTERNATIVES

	LRT 1		Combo 1	RRT
	At-Grade	Partially Tunnelled ⁴		
Capital Cost (2010\$)	\$1.11 billion	\$1.38 billion to \$1.84 billion	\$2.67 billion	\$3.01 billion
Lifecycle cost (PV, 2010\$, 6% discount rate)	\$620 million	\$970 million to \$1.15 billion	\$1.49 billion	\$1.75 billion
New weekday transit trips (2041)	11,000	13,500	44,000	54,000
Regional transit mode share (2041 AM Peak, base case =16.3%)	16.4%	16.4%	16.6%	16.6%
Travel time (2041 AM Peak, Comm / Bdwy to UBC, base case = 38 min)	28 min	27 to 26 min	29 min	19 min

4. The range of values for partially tunnelled LRT1 corresponds to a tunnel of between 1.7km and 4.4 km in length under central Broadway. These represent high-level estimates, as a full multiple account evaluation has not been conducted of partially tunnelled LRT.

An assessment of affordability can only be made by considering regional investment needs relative to available funding. Such an assessment will be done as part of the Regional Transportation Strategy.

CAPACITY AND EXPANDABILITY

All three alternatives have sufficient capacity to meet forecast demand to 2041 and beyond under a range of growth and demand scenarios. Combination 1 and RRT alternatives could be expanded by up to 100 per cent beyond the capacity assumed for the analysis. LRT1 has 25 per cent spare capacity under the base case assumptions in 2041 and could be expanded by increasing train frequency, which would reduce the level of signal priority provided and therefore reduce the travel time and reliability benefits during peak periods.

The potential need for expandability on the Broadway Corridor beyond the 30-year appraisal period will be a consideration for the Regional Transportation Strategy where the benefits and costs of investment in additional capacity can be weighed against other investment needs in the region.

PHASING

The analysis has considered fully-built alternatives connecting Commercial Drive and UBC and has not assessed phasing options in detail. Phasing would spread out the capital requirements over a longer period of time, but potentially add some incremental costs. Both Combination 1 and RRT could be built in phases through, for example, extending SkyTrain to Arbutus as an interim step towards extending rapid transit to UBC. Implementation of rapid transit to UBC would be delayed and this could result in ongoing crowding in the western segment of the corridor and would require a commitment to increased bus service to meet demand. This would create local impacts associated with continued reliance on buses, such as the requirement for a major interchange with bus layover space at Arbutus. Consideration of phasing warrants further review through the Regional Transportation Strategy in the context of affordability.

STREET-LEVEL VS. TUNNELLED OPERATION

The LRT1 (and most of the LRT portion of Combination 1) design assumes street-level operation in a dedicated median which would affect traffic, parking, local access and goods

movement and have other impacts from turning restrictions and reduced road capacity. The analysis has identified that these impacts do not affect the viability of the LRT alternative. However, part of the LRT could be built in a tunnel where the street is busiest to reduce the street-level impacts and improve reliability and speed benefits. Depending on the length of the underground segment, this would increase the cost of the LRT1 alternative by \$300 to \$750 million dollars. The LRT portion of Combination 1 avoids the Central Broadway section where tunnelling is a consideration for LRT1. Further consideration of partially-tunnelled LRT should be considered in the Regional Transportation Strategy.

Stakeholder Perspectives

The analysis has been undertaken in close partnership with stakeholders, including the City of Vancouver and UBC, who broadly support the technical findings to date. However, consensus has not been reached on all interpretations of the findings. Concerns identified by some stakeholders include the sufficiency of LRT capacity over the long term, the impact of surface LRT on urban design, the nature of economic development benefits of the various alternatives, and the thoroughness of the assessment of phasing.

Stakeholder perspectives on these recommendations will be solicited following completion of the analysis through staff participation in the Regional Transportation Strategy. In addition, partner agencies may provide additional comments through their governing bodies.

Next Steps

Major decisions on system investment are best made as part of a comprehensive regional planning process that considers the associated policy measures that are needed to pay for and to ensure optimal performance of any investments. Decisions on system investment, including rapid transit, also require a dialogue that provides policy-makers from all parts of the region with a forum to make tradeoffs between the various regional investment needs in light of funding opportunities and constraints. Ultimately, a decision on a preferred rapid transit network will be made as part of the overall decision on a preferred multi-modal system plan.

This regional decision-making needs to trade-off and balance limited resources across competing regional needs. To do so, decision criteria would include: performance, affordability, deliverability and strategic fit from a whole system perspective. Policy-makers have the role of determining priorities and balancing between:

- Modes
- State of good repair vs. expansion
- Sub-areas geographically across the region
- Shaping vs. serving land use and travel demand
- Equity/fairness vs. high performance
- Desire to invest vs. willingness to pay

The decision on the preferred option will be considered through the Regional Transportation Strategy so that decision-makers can discuss the tradeoffs between the various regional investment needs in light of funding opportunities and constraints. The UBC Line Rapid Transit Alternatives Analysis evaluation and technical findings to date provide the input necessary for that regional dialogue.

TransLink will facilitate a regional discussion with the public, stakeholders and elected officials to examine the trade-offs of each option, along with the other regional transportation priorities, and to determine the path forward.