

# UBC Line Rapid Transit Study



Webinar  
April 04, 2011

# Why Study Rapid Transit?

## Broadway: a regionally important corridor

*Diversity of unique neighbourhoods supporting residential, commercial, and institutional areas*

*30% more jobs & people expected by 2041*

*Over 100,000 daily trips by bus, connecting major population, job and institutional centres*

## Need for fast, frequent, and reliable service

*Travel time is unpredictable – 25-45 minutes from Commercial Drive to UBC depending on the time of day*

*Buses are reaching capacity – 2,000 people passed up by full buses in the morning rush*

## Ambitious goals

*Double transit ridership by 2020 (Province)*

*Reduce GHG emissions by 100% by 2050 (UBC)*

*Shift 50% of all trips to transit, cycling, and walking (TransLink & CoV)*



# We Are Here

SUMMER 2009 –  
SPRING 2010

## Phase 1

Identify shortlist  
alternatives



SPRING 2010 –  
LATE 2011/EARLY 2012

## Phase 2

Design development  
Evaluate the alternatives



TO BE DETERMINED

## Phase 3

Design of preferred  
alternative, potential phasing,  
timeline for implementation

Stakeholder consultation

Public consultation

# Phase 1 Consultation

- 17 stakeholder meetings between June 2009 and April 2010
  - Study introduction
  - Evaluation process
  - Defining the need for rapid transit
  - Technologies under consideration
  - Recommended shortlist of rapid transit alternatives
- Public consultation – May 2010
  - 2,300 online questionnaires
  - 240 comments submitted online
  - Five community workshops with 400 attendees



# Seven Rapid Transit Alternatives



## **BRT Alternative**

Bus Rapid Transit links Commercial-Broadway Station to UBC



## **LRT Alternative 1**

Two options for Light Rail Transit linking Commercial-Broadway Station to UBC



## **LRT Alternative 2**

Light Rail Transit Alternative 1 **plus** a link from Main Street-Science World Station



## **RRT Alternative**

Two options for Rail Rapid Transit linking Commercial-Broadway Station to UBC



## **Combo Alternative 1**

Uses a combination of Light Rail Transit and Rail Rapid Transit



## **Combo Alternative 2**

Uses a combination of Bus Rapid Transit and Rail Rapid Transit



## **Best Bus Alternative**

Optimizes east-west bus service with improvements to conventional bus transit



# Phase 2 Design and Evaluation

- Design – we made assumptions to develop design concepts
  - Is it in a tunnel, at street level or elevated?
  - Where are potential station locations?
  - For street-level alternatives, where are they positioned within the street?
  - What are the impacts to the street? (e.g. intersection restrictions and parking impacts)
- Evaluation – we then evaluated the alternatives
  - Seven accounts
  - Considered several criteria in each account

# Your Input is Needed

Your input will help refine the designs and finalize the evaluation

- Have we made the right design assumptions?
- Has the range of benefits and impacts been considered in the evaluation? Have we missed anything?
- What advice would you give decision-makers?

*We're not making decisions about the preferred alternative right now*

BRT

LRT 1

LRT 2

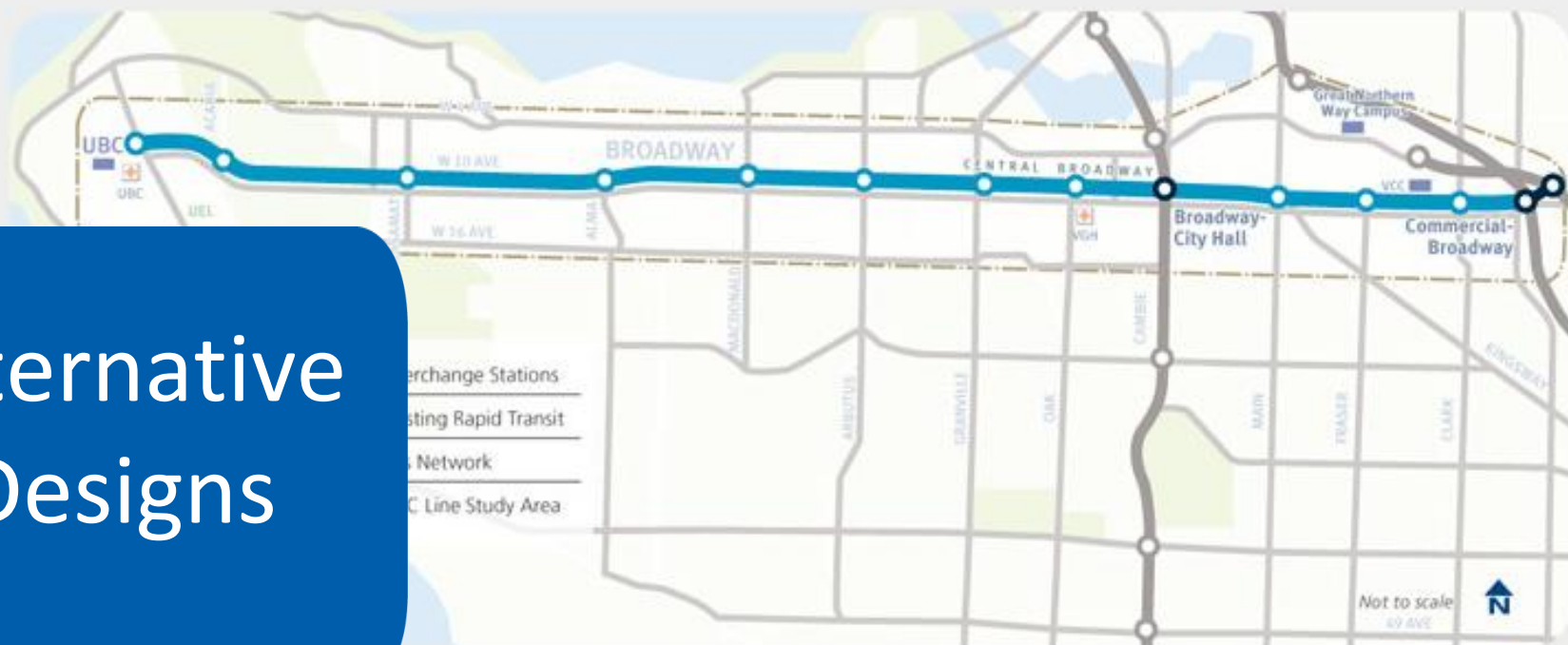
RRT

Combo 1

Combo 2

Best Bus

# Alternative Designs



## Bus Rapid Transit Alternative

### Technology

### Alignment

### Stations

### Integration

#### TRAVEL TIME

Commercial Dr  
– UBC 33 mins

Commercial Dr  
– Cambie St 9 mins

#### COSTS

Capital Costs  
(\$2010) Diesel \$350M  
Trolley \$450M

Incremental  
Operating Costs  
(\$2010)\* Diesel \$-1M  
Trolley \$-2M

#### RIDERSHIP

Projected Daily  
Boardings  
Estimate (2021) 75,000

*\*Relative to the "business as usual" bus network; a negative number means savings due to lower bus operating costs.*



In the Street

At Intersections

By Segment

### TYPICAL FOUR-LANE SEGMENT

Without Street-level Rapid Transit



## Street Integration – In the Street



Four-Lane Segment

Six-Lane Segment

To fit BRT and LRT in the street, roughly six to seven metres of space is required along most of the route and nine to 12 metres at stations. This means adjusting how road space is shared with other users (pedestrians, cyclists, transit, goods movement vehicles and private cars).

Here are some ways that can be done:

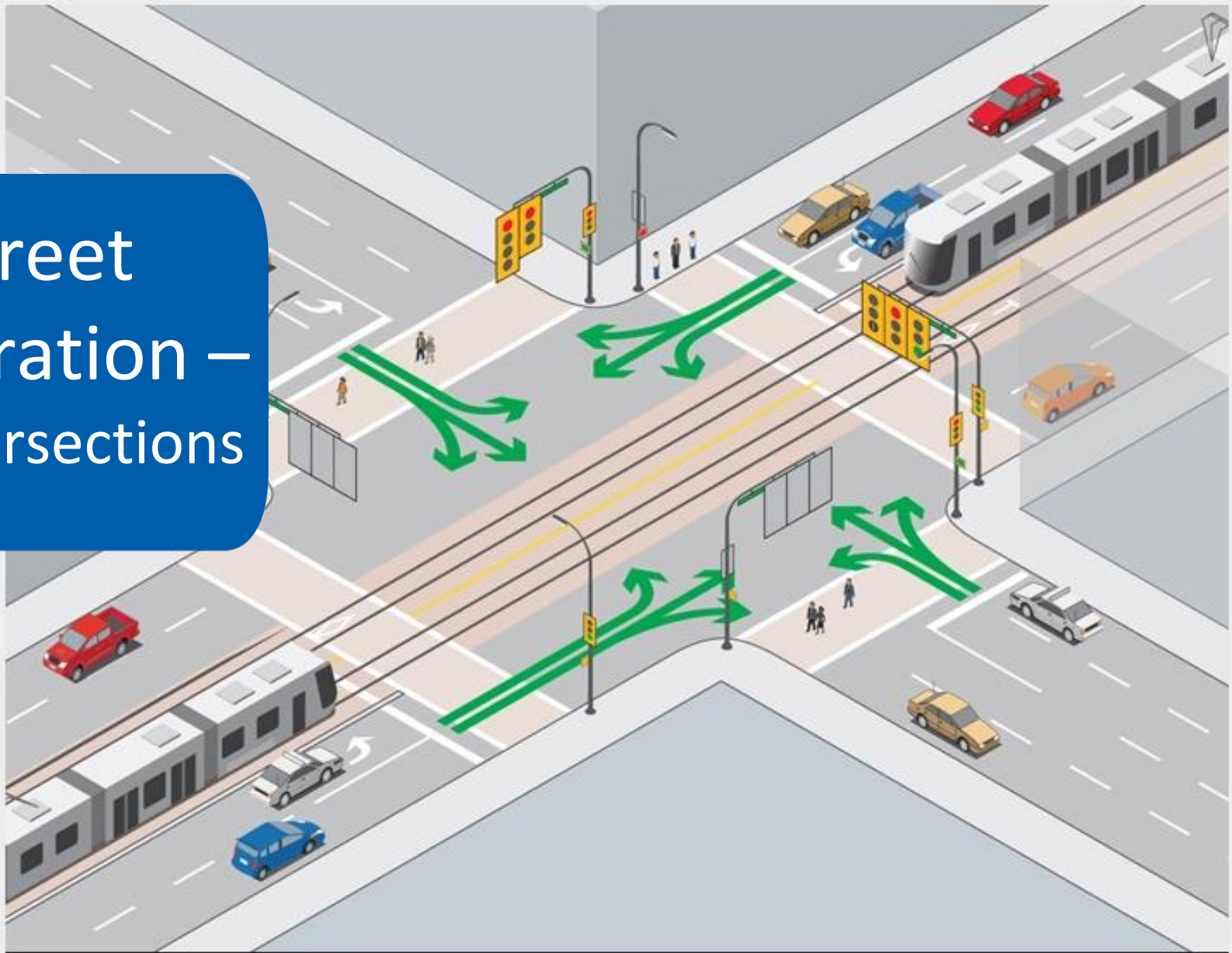
- A. Reduce the number of vehicle lanes. Rapid transit moves more people and can shift people out of their cars.
- B. Remove left turn bays at some intersections with stations to make room for platforms.
- C. Move or reduce on-street parking on one or both sides of the street.
- D. Reduce sidewalk width to retain parking or vehicle lanes. Typically sidewalk reduction is greater at stations to allow for platforms.
- E. Increased sidewalk width may be possible where parking and vehicle lanes are removed and reallocated space is available.

In the Street

At Intersections

By Segment

# Street Integration – At Intersections



No Restrictions

Left Turn Restrictions

Right-In/Right-out

In the Street

At Intersections

By Segment

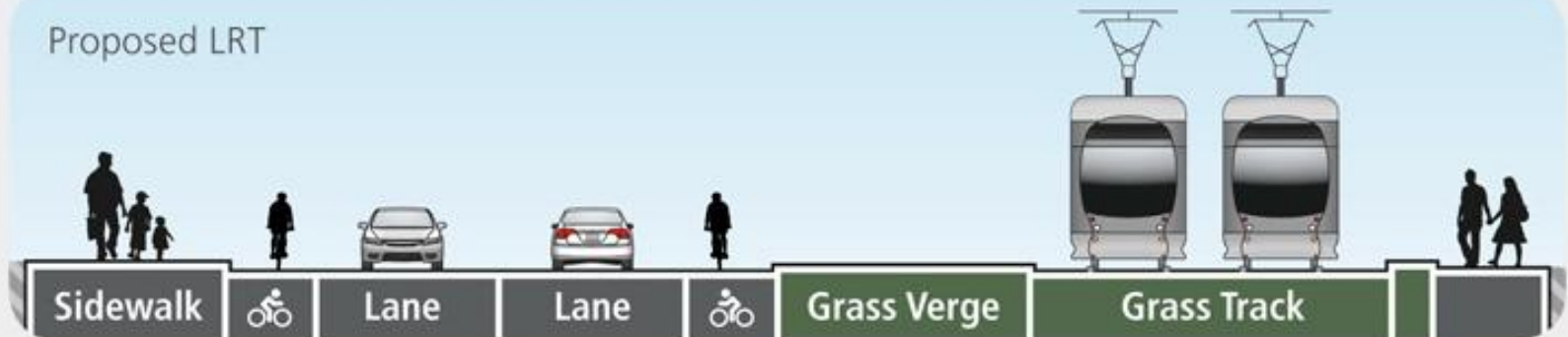
Current



# Street Integration – By Segment



Proposed LRT



Univ. Blvd

Blanca/Alma

Alma/Arbutus

Arbutus/Commercial

Great Northern Way

False Crk



# UBC Line Rapid Transit Study



## Phase 2 Evaluation

# Phase 2 Evaluation

Accounts	Criteria Considered
Economic Development	Construction effects, taxes, goods movement
Environment	Emissions reduction, noise and vibration, bio-diversity, water environment, parks and open space
Financial	Capital cost, operating cost, cost-effectiveness
Social and Community	Health effects, low income population served, safety, community cohesion, heritage and archaeology
Transportation	Transit users, non-transit users, system access, reliability, capacity and expandability
Urban Development	Land use integration, land use potential, property requirements, urban design potential
Deliverability	Constructability, acceptability, funding and affordability



# Alternatives Evaluation – Summary

Summary	Econ	Enviro	Social	Financial	Transport	Urban Dev	Deliverability
ACCOUNT	BEST BUS	BRT Diesel / Trolley	LRT 1 Option A / Option B	LRT 2 Option A / Option B	RRT Option A / Option B	COMBO 1	COMBO 2
Economic Development							
Deliverability							

Very Poor

Poor

Neutral

Good






















Very Good

## Summary


### Evaluating the Alternatives

Each alternative was evaluated across seven different accounts to identify its range of benefits and impacts, using planning tools such as transportation demand forecasting and financial models, and qualitative assessments.

For each account, we compared each alternative against a "business as usual" scenario that considers only anticipated transit improvements according to past trends and no rapid transit in the corridor. Several criteria within each account were considered. We then scored each alternative on a five-point scale for each criterion. The results were summarized into a single score for each alternative for that account (shown above).

ACCOUNT	BEST BUS	BRT Diesel / Trolley	LRT 1 Option A / Option B	LRT 2 Option A / Option B	RRT Option A / Option B	COMBO 1	COMBO 2
							
							
							
							

# Alternatives Evaluation – By Account

 Very Poor  Poor  Neutral  Good  Very Good

Economic

## Economic Development Account At A Glance

**Objective:** A service that encourages economic development by improving access to existing and future major regional destinations and local businesses by transit while continuing to facilitate goods movement.

**Benefits and Impacts Considered:** The economic benefits generated by construction activity, impact on taxes and goods movement.

**Summary Results:** Alternatives with higher capital costs and longer construction periods, such as RRT, tend to perform best in this account due to the employment opportunities generated by construction.

# Preliminary Conclusions & Next Steps

More technical work and public input needed before results are finalized.  
Initial conclusions include:

- BRT does not have sufficient capacity to meet projected demand
- Two design options have been evaluated for RRT and LRT between Main Street and Commercial Broadway:

RRT 1B (an extension of the Millennium line that serves Great Northern Way) performs better than RRT 1A (a stand-alone system directly via Broadway)



Further study is required to determine whether LRT 1A (directly via Broadway or LRT 1B (via Great Northern Way) is stronger.



# Preliminary Conclusions & Next Steps

- Design optimization is needed, which will affect evaluation results. For example
  - BRT and LRT have some negative impacts on road users due to reduced road capacity and intersection restrictions. These may be reduced through further design refinements.
- The evaluation was based on assumptions about population, employment and student growth and further refinements could affect forecast demand.
- Alternatives that generate the most benefits are also the most costly. Tradeoffs between benefits and costs will need to be made in determining the right solution for the corridor.

# Evaluation Summary


A Multiple Account Evaluation considered a range of costs, benefits and impacts of the alternatives relative to "business as usual."
















































 Very Poor

 Poor

 Neutral

 Good

 Very Good

ACCOUNT	CRITERIA CONSIDERED	BEST BUS	BRT Diesel/Trolley	LRT 1 Option A/Option B	LRT 2 Option A/Option B	RRT Option A/Option B	COMBO 1	COMBO 2
Economic Development	Construction Effects, Tax Effects, Goods Movement							
Environment	Emissions Reduction, Noise and Vibration, Biodiversity, Water Environment, Parks and Open Space		 / 			 / 		
Financial	Capital Cost, Operating Cost, Cost Effectiveness			 / 		 / 		
Social and Community	Health Effects, Low Income Population Served, Safety, Community Cohesion, Heritage and Archaeology					 / 		
Transportation	Transit Users, Non-Transit Users, Transit Network/System Access, Reliability, Capacity and Expandability							
Urban Development	Land Use Integration, Land Use Potential, Property Requirements, Urban Design Potential							
Deliverability	Constructability, Acceptability, Funding and Affordability	TBD	TBD	TBD	TBD	TBD	TBD	TBD



# What public input are we seeking?

**Now:** input to shape the design and evaluation of the alternatives

- Have we made the right design assumptions?
- Has the range of benefits and impacts been considered in the Evaluation? Have we missed anything?
- What advice would you give decision-makers?

**Future** opportunities for input:

- Input on final study findings at the end of Phase 2
- Detailed design of preferred alternative in Phase 3

# Next Steps

SUMMER 2009 –  
SPRING 2010

## Phase 1

Identify shortlist  
alternatives



SPRING 2010 –  
LATE 2011 / EARLY 2012

## Phase 2

Design development  
Evaluate the alternatives



TO BE DETERMINED

## Phase 3

Design of preferred  
alternative, potential phasing,  
timeline for implementation

Stakeholder consultation

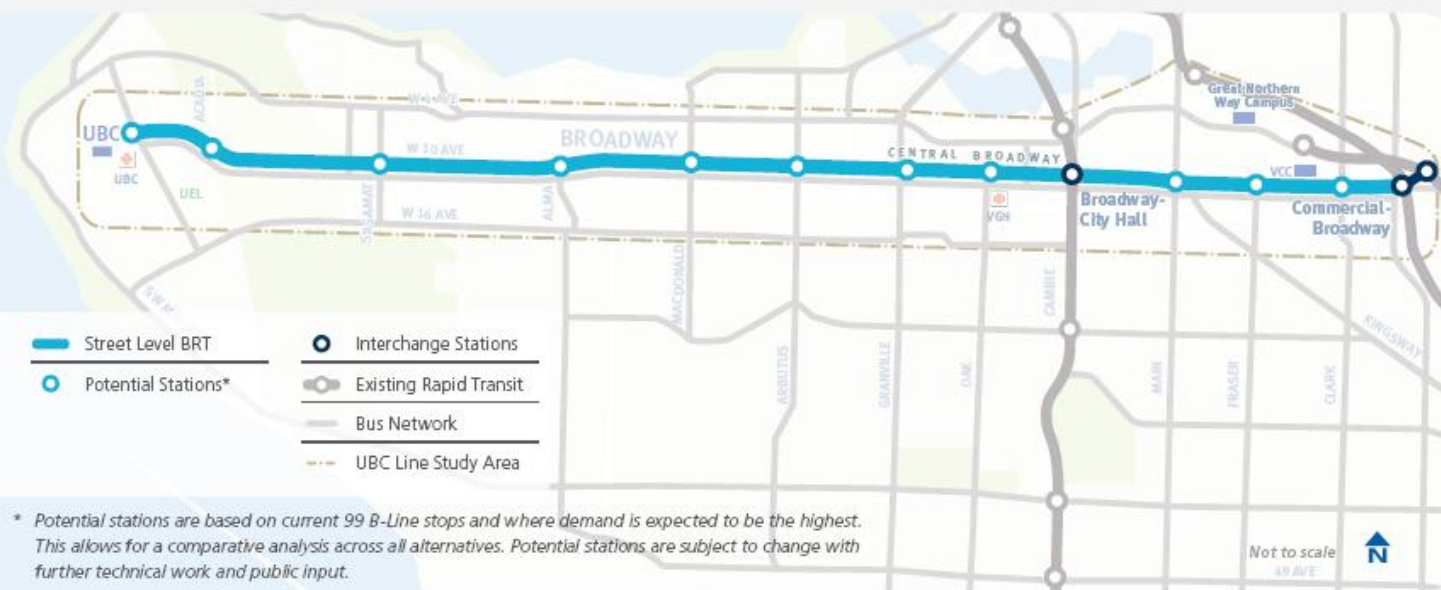
Public consultation

# Thank You!

[www.translink.bc.ca/ubcline](http://www.translink.bc.ca/ubcline)



## Bus Rapid Transit Alternative



### TRAVEL TIME

Commercial Dr  
– UBC 33 mins

Commercial Dr  
– Cambie St 9 mins

### COSTS

Capital Costs  
(\$2010) Diesel \$350M  
Trolley \$450M

Incremental  
Operating Costs  
(\$2010)\* Diesel \$-1M  
Trolley \$-2M

### RIDERSHIP

Projected Daily  
Boardings  
Estimate (2021) 75,000

\*Relative to the 'business as usual' bus network.

### TECHNOLOGY



BRT uses rubber tire, low-floor articulated buses that can run on diesel, compressed natural gas (CNG), or electricity. Diesel and Trolley options for BRT were evaluated.

For more information on how BRT and LRT fit in the street, see page 11.

### ALIGNMENT



photo rendering: Bayswater

The BRT Alternative operates primarily in the centre of the street with a side-running section on University Boulevard. It is in its own right of way, separated from other traffic by a curb. Signal priority is not provided for this alternative in order to maximize the frequency and capacity of the service.

### STATION TYPE



photo credit: C-TRAN, Vancouver WA

BRT stations are typically located within the street right of way, and connect to either side of the street with pedestrian crossings. Stations are sheltered and typically feature ticket vending machines, closed circuit TV for security, seating, real-time information and wayfinding.

### INTEGRATION WITH OTHER MODES

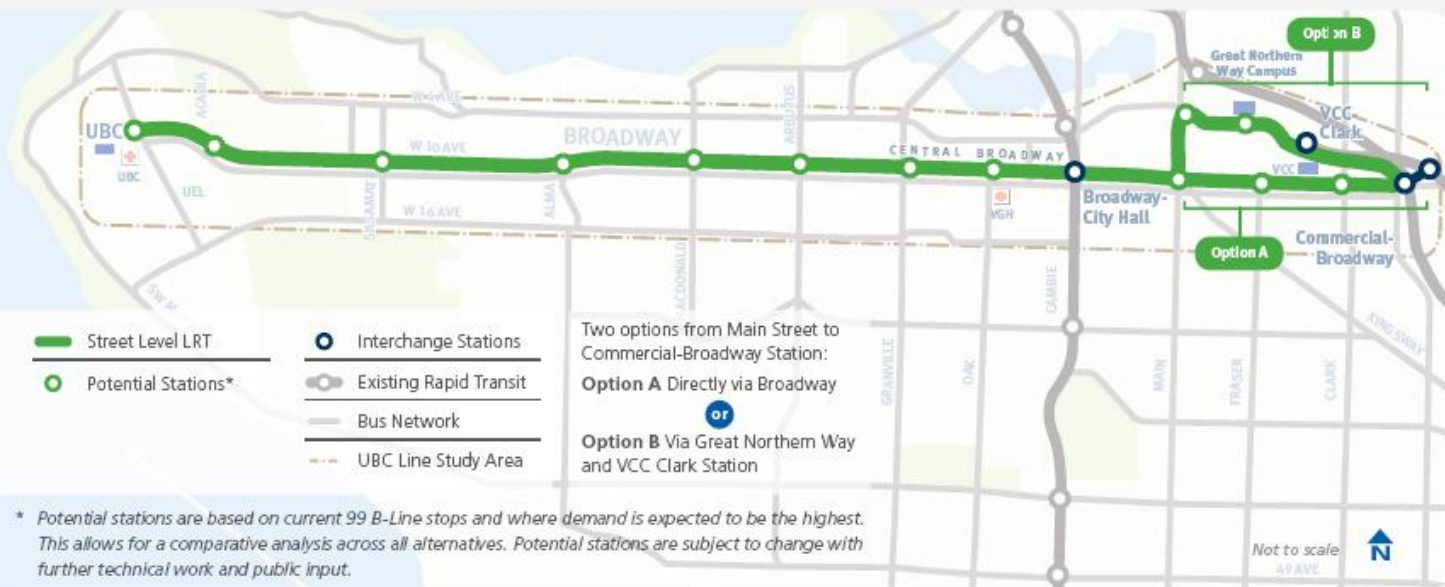


This alternative provides three connections to existing rapid transit. Local buses operate in mixed traffic lanes. Bus service that duplicates the rapid transit service is eliminated (e.g. 99 B-Line), but local buses will continue to operate in the corridor. There are no changes to pedestrian and cyclist crossings.





## Light Rail Transit Alternative 1



### TRAVEL TIME

Commercial Dr – UBC	<b>A</b> 26 mins
	<b>B</b> 29 mins

Commercial Dr – Cambie St	<b>A</b> 7 mins
	<b>B</b> 9 mins

### COSTS

Capital Costs (\$2010)	<b>A</b> \$1.1B
	<b>B</b> \$1.1B

Incremental Operating Costs (\$2010)*	<b>A</b> \$-3M
	<b>B</b> \$-6M

### RIDERSHIP

Projected Daily Boardings Estimate (2021)	<b>A</b> 99,000
	<b>B</b> 109,000

\*Relative to the 'business as usual' bus network.

### TECHNOLOGY



LRT is a driver-operated, electrically-powered technology that can operate at street-level.

For more information on how BRT and LRT fit in the street, see page 11.

### ALIGNMENT



photo rendering: Willow

LRT Alternative 1 operates primarily in the centre of the street with a side-running section on University Boulevard. It is in its own right of way separated from other traffic by a curb with signal priority at intersections.

### STATION TYPE



Stations are typically located within the street, and connect to both sides of the street with pedestrian crossings. Stations are sheltered and typically feature ticket vending machines, closed circuit TV for security, seating, real-time information and wayfinding.

### INTEGRATION WITH OTHER MODES

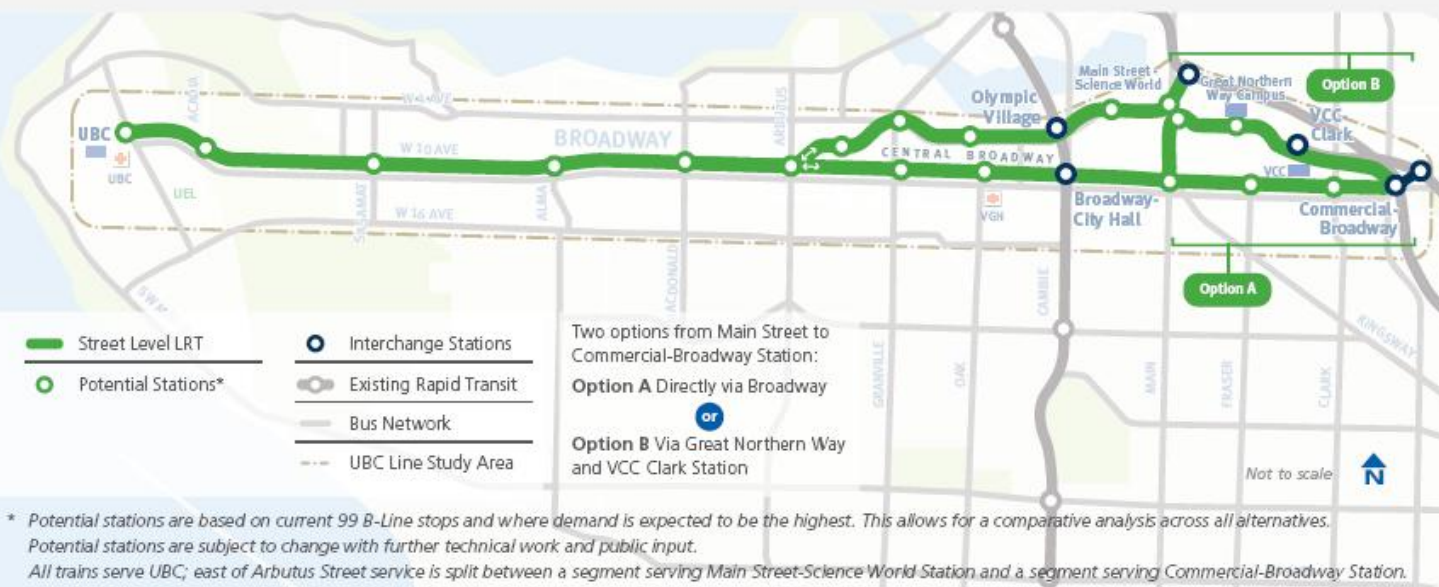


This alternative provides three connections to existing rapid transit. Local buses operate in mixed traffic lanes. Bus service that duplicates the rapid transit service is eliminated (e.g. 99 B-Line), but local buses will continue to operate in the corridor. There are no changes to pedestrian and cyclist crossings.





## Light Rail Transit Alternative 2



### TRAVEL TIME

Commercial Dr – UBC	<b>A</b> 26 mins <b>B</b> 29 mins
Commercial Dr – Cambie St	<b>A</b> 7 mins <b>B</b> 9 mins
Main St.-Science World – UBC	25 mins

### COSTS

Capital Costs (\$2010)	<b>A</b> \$1.3B <b>B</b> \$1.4B
Incremental Operating Costs (\$2010)*	<b>A</b> \$-3M <b>B</b> \$-2M

### RIDERSHIP

Projected Daily Boardings Estimate (2021)	<b>A</b> 107,000 <b>B</b> 116,000
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\*Relative to the 'business as usual' bus network.

### TECHNOLOGY



LRT is a driver-operated, electrically-powered technology that can operate at street-level.

For more information on how BRT and LRT fit in the street, see page 11.

### ALIGNMENT



photo rendering: Bayswater

LRT Alternative 2 operates primarily in the centre of the street with a side-running section on University Boulevard. It is in its own right of way separated from other traffic by a curb with signal priority at intersections. Between Arbutus Street and Main Street-Science World Station, the alternative operates along the former rail line.

### STATION TYPE



Stations are typically located within the street, and connect to both sides of the street with pedestrian crossings. Stations are sheltered and typically feature ticket vending machines, closed circuit TV for security, seating, real-time information and wayfinding.

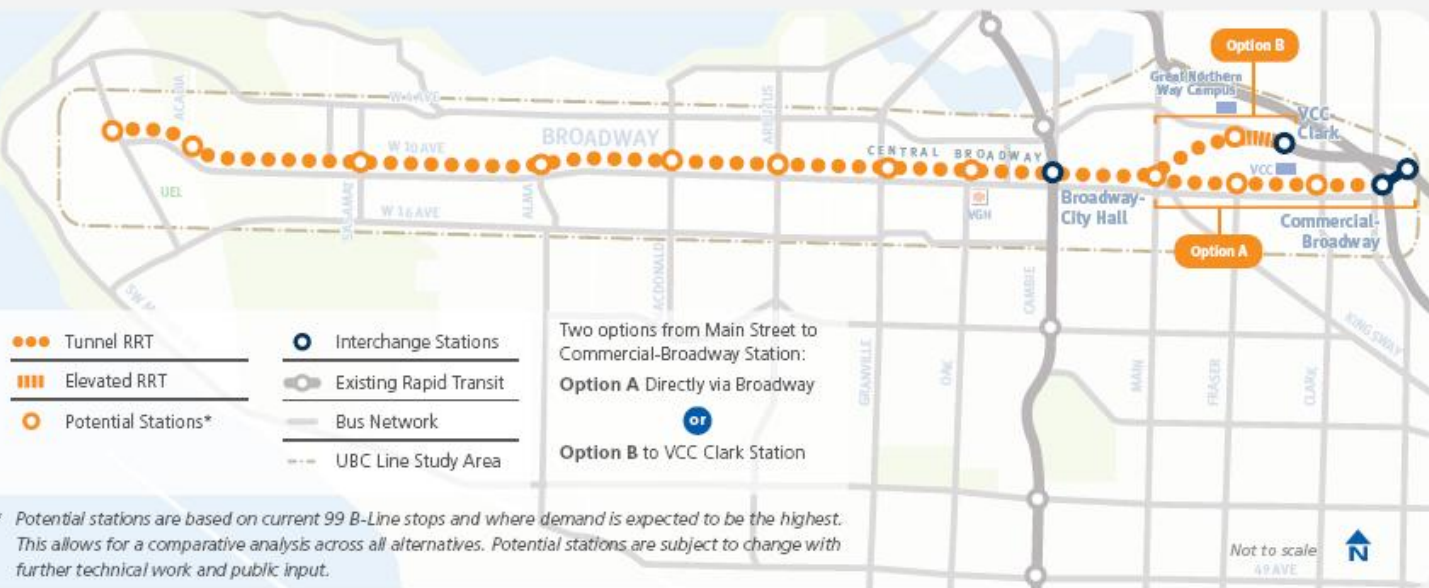
### INTEGRATION WITH OTHER MODES



This alternative provides five connections to existing rapid transit. Local buses operate in mixed traffic lanes. Bus service that duplicates the rapid transit service is eliminated (e.g. 99 B-Line), but local buses will continue to operate in the corridor. There are no changes to pedestrian and cyclist crossings.



## Rail Rapid Transit Alternative



### TRAVEL TIME

Commercial Dr – UBC	<b>A</b> 20 mins
	<b>B</b> 20 mins
Commercial Dr – Cambie St	<b>A</b> 6 mins
	<b>B</b> 6 mins

### COSTS

Capital Costs (\$2010)	<b>A</b> \$3.2B
	<b>B</b> \$2.9B
Incremental Operating Costs (\$2010)*	<b>A</b> \$-3M
	<b>B</b> \$-7M

### RIDERSHIP

Projected Daily Boardings Estimate (2021)	<b>A</b> 137,000
	<b>B</b> 146,000

\*Relative to the 'business as usual' bus network.

### TECHNOLOGY



RRT is an automated or driver-operated rail technology that is powered by electricity. In Metro Vancouver, RRT (e.g. SkyTrain) is automated and operates separately from other road users.

### ALIGNMENT



The RRT Alternative operates primarily in a bored tunnel with an elevated section between Great Northern Way and VCC-Clark Station to connect with the existing system. A section on University Boulevard is assumed to be cut and cover.

### STATION TYPE



Stations feature ticket vending machines, closed circuit TV for security, seating, real-time information, wayfinding, and are accessed by elevators, escalators and stairs.

### INTEGRATION WITH OTHER MODES

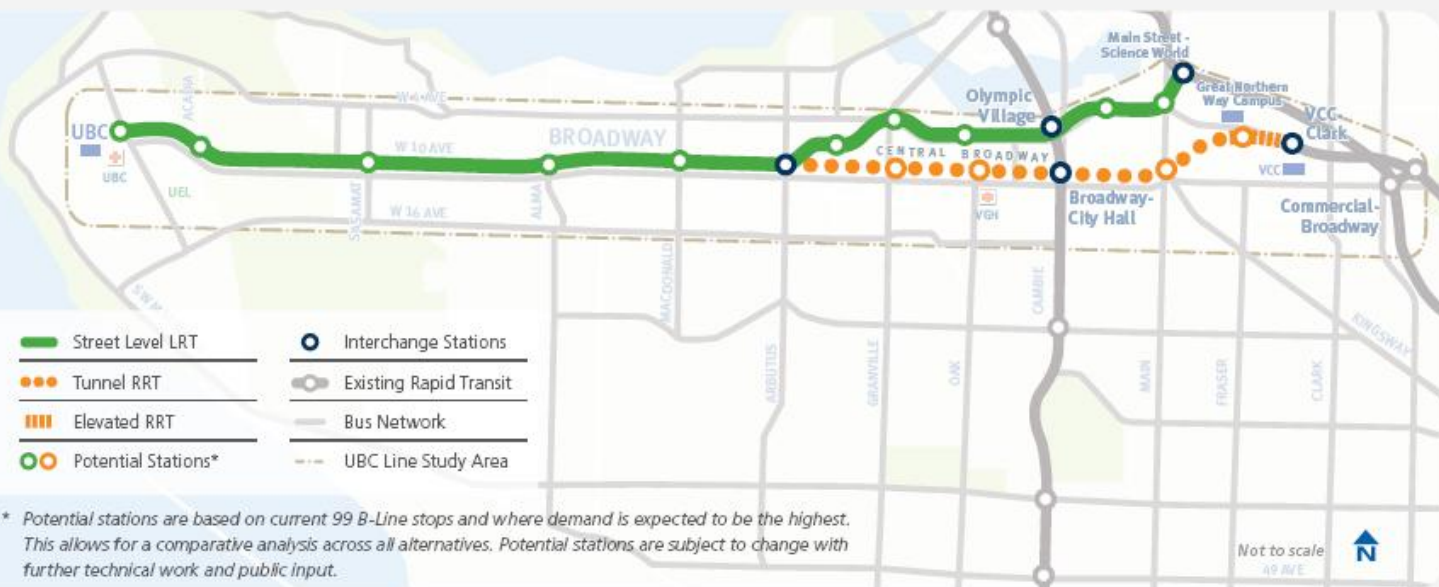


This alternative provides three connections to existing rapid transit. Option B is an extension of the Millennium Line. Local buses continue to operate on the surface in mixed traffic. Bus service that duplicates the rapid transit service is eliminated (e.g. 99 B-Line). There are no changes to pedestrian and cyclist crossings.





## Combination Alternative 1



### TRAVEL TIME

Main St.-Science World – UBC	25 mins
Commercial Dr – UBC	27 mins
Commercial Dr – Cambie	6 mins

### COSTS

Capital Costs (\$2010)	\$2.4B
Incremental Operating Costs (\$2010)*	\$-5M

### RIDERSHIP

Projected Daily Boardings Estimate (2021)	145,000
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\*Relative to the 'business as usual' bus network.

## TECHNOLOGY



LRT



RRT

LRT is a driver-operated, electrically-powered technology that can operate at street-level.

RRT is an automated or driver-operated rail technology that is powered by electricity. In Metro Vancouver, RRT (e.g. SkyTrain) is automated and operates separately from other road users.

For more information on how BRT and LRT fit in the street, see page 11.

## ALIGNMENT



photo rendering: Moberly

LRT operates between UBC and Main Street-Science World Station primarily in the centre of the street with a side-running section on University Boulevard. It is in its own right of way separated from other traffic by a curb with signal priority at intersections. Between Arbutus Street and Main Street-Science World Station, it operates along the former rail line.

RRT between Arbutus Street and VCC-Clark Station, operates primarily in a bored tunnel with an elevated section between Great Northern Way and VCC-Clark Station to connect with the existing system.

## STATION TYPE



LRT stations are located within the street right of way. Pedestrian crossings connect station platforms to both sides of the street. RRT stations are accessed by elevators, escalators and stairs.

Both LRT and RRT stations are sheltered and typically feature ticket vending machines, closed circuit TV for security, seating, real-time information, and wayfinding.

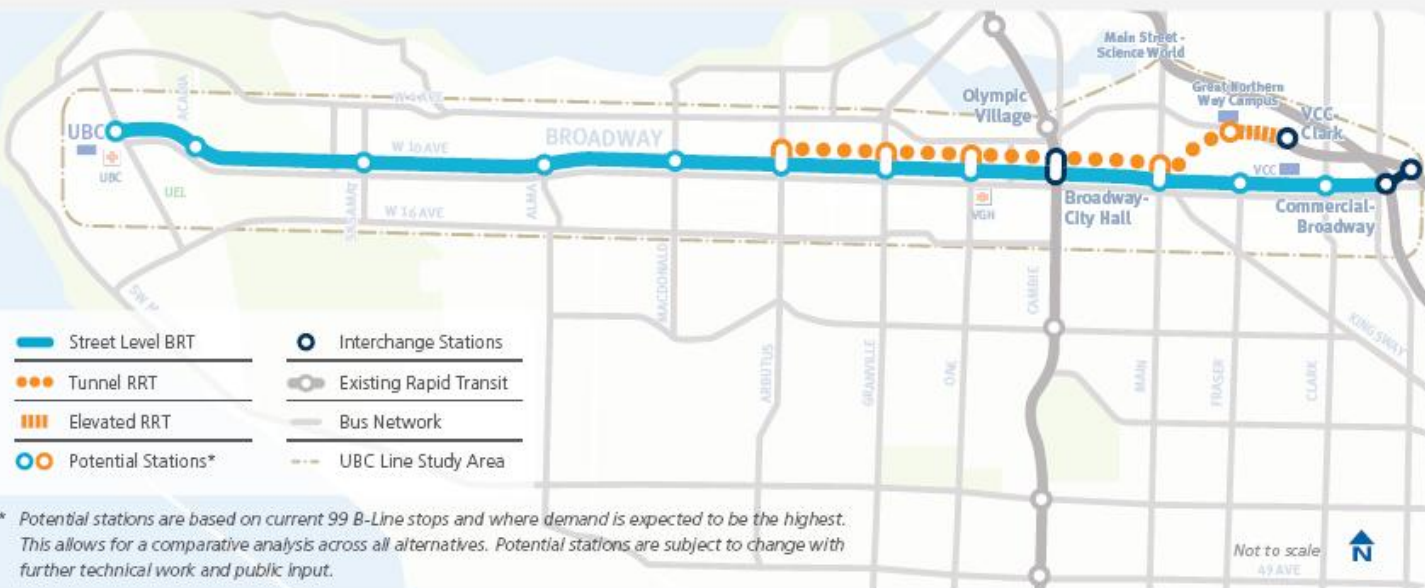
## INTEGRATION WITH OTHER MODES



This alternative provides five connections to existing rapid transit. The RRT segment is an extension of the Millennium Line. Local buses operate in mixed traffic lanes. Bus service that duplicates the rapid transit service is eliminated (e.g. 99 B-Line), but local buses will continue to operate in the corridor. There are no changes to pedestrian and cyclist crossings.



## Combination Alternative 2



### TRAVEL TIME

Commercial Dr – UBC	32 mins
Commercial Dr – Cambie	6 mins

### COSTS

Capital Costs (\$2010)	\$1.9B
Incremental Operating Costs (\$2010)*	\$4M

### RIDERSHIP

Projected Daily Boardings Estimate (2021)	138,000
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\*Relative to the 'business as usual' bus network.

### TECHNOLOGY



BRT



RRT

BRT uses rubber tire, low-floor articulated buses that can run on diesel, compressed natural gas (CNG) or electricity.

RRT is an automated or driver-operated rail technology that is powered by electricity. In Metro Vancouver, RRT (e.g. SkyTrain) is automated and operates separately from other road users.

For more information on how BRT and LRT fit in the street, see page 11.

### ALIGNMENT



photo rendering: Willow

BRT operates between UBC and Commercial-Broadway Station, primarily in the centre of the street with a side-running section on University Boulevard. It is in its own right of way, separated from other traffic by a curb.

RRT between Arbutus Street and VCC-Clark Station, operates primarily in a bored tunnel with an elevated section between Great Northern Way and VCC-Clark Station to connect with the existing system.



### STATION TYPE



photo credit: C-Train, Vancouver WA

BRT stations are located within the street right of way. Pedestrian crossings connect station platforms to either side of the street. RRT stations are accessed by elevators, escalators and stairs.

Both BRT and RRT stations are sheltered and typically feature ticket vending machines, closed circuit TV for security, seating, real-time information and wayfinding.



### INTEGRATION WITH OTHER MODES



This alternative provides three connections to existing rapid transit. The RRT segment is an extension of the Millennium Line. Local buses operate in mixed traffic lanes. Bus service that duplicates the rapid transit service is eliminated (e.g. 99 B-Line), but local buses will continue to operate in the corridor. There are no changes to pedestrian and cyclist crossings.





## Best Bus Alternative



### TRAVEL TIME ON BROADWAY

Commercial Dr – UBC 30 mins

Commercial Dr – Cambie St 6 mins

### COSTS

Capital Costs (\$2010) \$325M

Incremental Operating Costs (\$2010)\* \$18M

### RIDERSHIP\*\*

Projected Daily Boardings Estimate (2021) 75,000

\* Relative to the 'business as usual' bus network.

\*\* Ridership includes ridership on the 99 B-Line, 84 as well as proposed new limited stop services serving the corridor

### WHAT IS BEST BUS?



Bus service is improved on Broadway and parallel corridors through a range of measures including increasing bus frequency on existing routes, adding new express routes, improving transit priority (e.g. bus lanes, signal priority) and amenities like real-time information displays.

### MEASURES TO IMPROVE BUS SERVICE



- Frequency is improved on a number of routes including: 25, 33, 41, 43, 44, 49, 84 and 99.
- Limited stop express routes introduced between UBC and Commercial-Broadway as well as UBC and Main Street-Science World Stations.



- Potential to introduce curbside bus lanes on several streets including Broadway, 4th Avenue, 41st Avenue, King Edward Avenue and 49th Avenue.
- Transit signal priority at intersections on some corridors to improve transit speed and reliability.



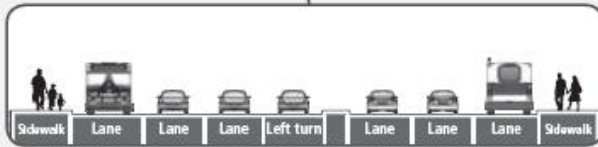
- Potential to enhance amenities at bus stops (e.g. providing real-time information displays and improved shelters).



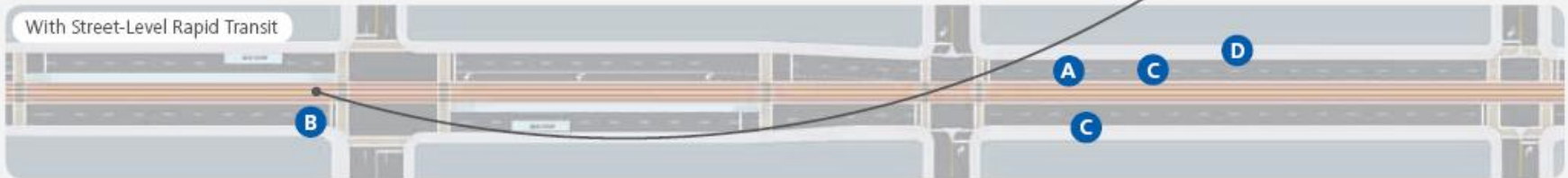
# Fitting BRT and LRT in the Street

## TYPICAL SIX-LANE SEGMENT

### Without Street-Level Rapid Transit



### With Street-Level Rapid Transit



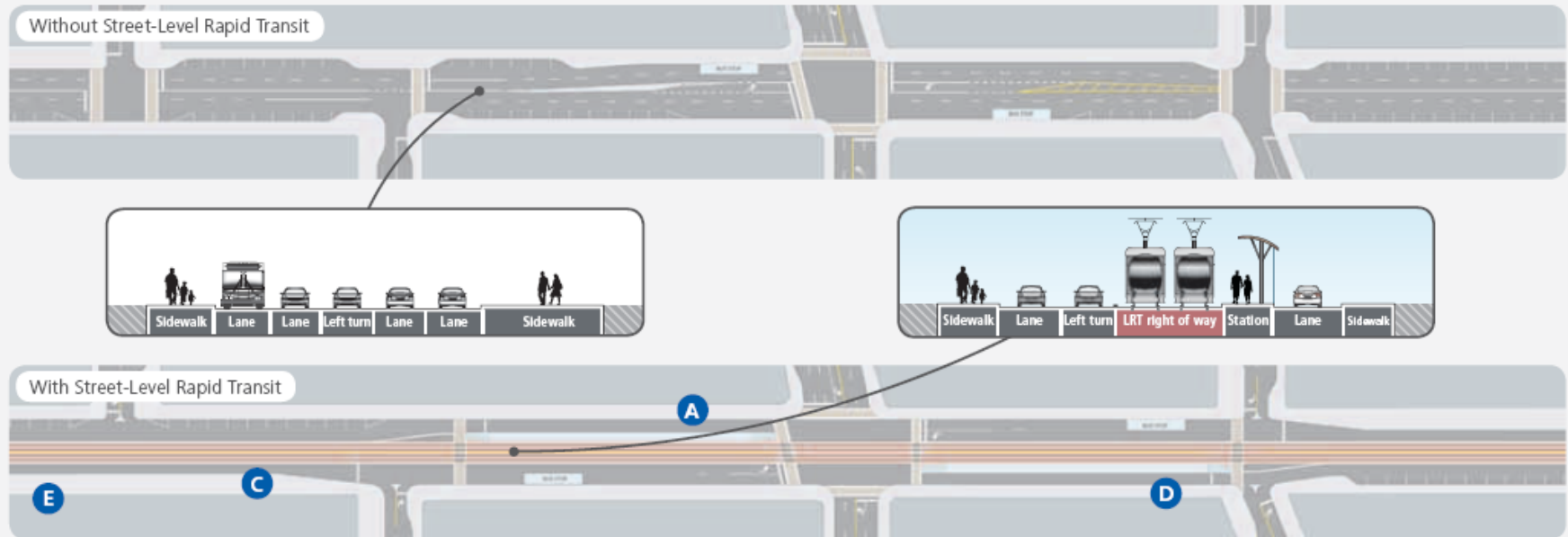
**A** Reducing the number of vehicle lanes is often possible because rapid transit allows more people to be moved by transit, shifting trips from cars.

**B** Removing left turn bays is proposed at some intersections with stations in order to fit in the platforms.

**C** Moving or reducing on-street parking on one or both sides of the street. Replacement parking, either off-street or inset parking bays, may be identified during Phase 3 detailed design.

# Fitting BRT and LRT in the Street

## TYPICAL FOUR-LANE SEGMENT



**D** **Reducing sidewalk width** is proposed in some areas to retain parking or vehicle lanes. Typically sidewalk reduction is greater at stations to allow space for the platforms.

**E** **Increasing sidewalk width** may be possible in some areas where parking and vehicle lanes or left-turns are removed to fit in the BRT or LRT system and reallocated space is available to widen the sidewalks.

**Purchasing property** may be done in some cases to widen the available road space to continue providing for all road users. This is a costly measure and only considered if the previous measures are not sufficient to fit the BRT or LRT system in the street.

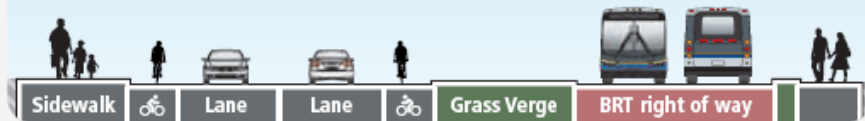
# Segment by segment

## UNIVERSITY BOULEVARD – BLANCA

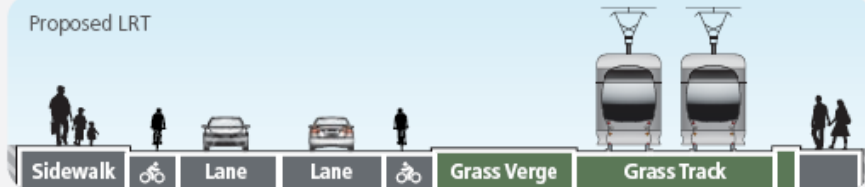
Current



Proposed BRT



Proposed LRT



**Sidewalk width:** Reduced at stations and bus stops; generally widened in other areas.

**Vehicle lanes:** No changes to number of vehicle lanes, some reduction in bike lane width.

**Parking:** No changes identified.

**Intersections:** No changes identified.

## BLANCA – ALMA

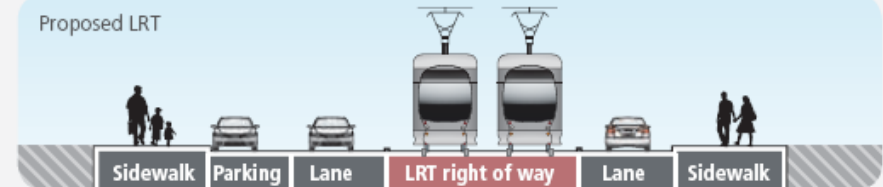
Current



Proposed BRT



Proposed LRT



**Sidewalk width:** Narrowed in most places; larger reductions at stations and intersections with left turn bays.

**Vehicle lanes:** Reduced from two lanes to one in each direction.

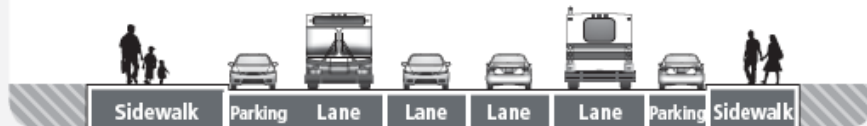
**Parking:** Parking on one side; no parking in blocks with bus stops to allow traffic to pass local buses.

**Intersections:** Major intersection turn movements generally permitted as before. Most minor intersections converted to "right-in / right-out."

# Segment by segment

## ALMA – ARBUTUS

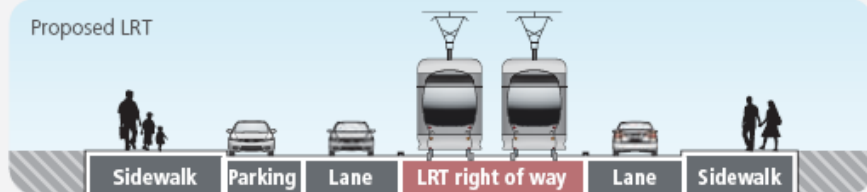
Current



Proposed BRT



Proposed LRT



**Sidewalk width:** Reduced at stations, bus stops and intersections with left turn bays, but generally widened in other areas; bulges removed where parking is eliminated.

**Vehicle lanes:** Reduced from two lanes to one in each direction.

**Parking:** Parking on one side only; no parking in blocks with bus stops to allow traffic to pass local buses.

**Intersections:** Major intersection turn movements generally permitted as today. Most minor intersections converted to "right-in / right-out."

## ARBUTUS – COMMERCIAL

Current



Proposed BRT



Proposed LRT



**Sidewalk width:** Narrowed in most places; larger reductions at stations and intersections with left turn bays.

**Vehicle lanes:** Two travel lanes retained, as today. Current peak period bus lanes no longer provided.

**Parking:** Parking, now primarily available in off-peak periods, is removed.

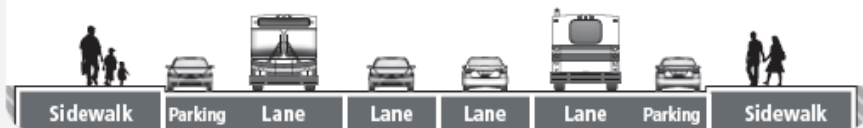
**Intersections:** Current peak period turning restrictions become full-time restrictions. Additional left turn restrictions at some stations (e.g. Cambie, Commercial). Most minor intersections converted to "right-in / right-out."

# Segment by segment

## GREAT NORTHERN WAY

LRT Alternatives Option B only

Current



Proposed LRT



**Sidewalk width:** Narrowed in most places; larger reductions at the stations.

**Vehicle lanes:** No change in the number of vehicle lanes.

**Parking:** Parking removed on both sides.

**Intersections:** No changes identified.

## CAMBIE STREET TO MAIN STREET (ON 1ST AVENUE)

LRT Alternative 2 only

Current



Proposed LRT



**Sidewalk width:** Reduced at stations. In other areas, generally no change.

**Vehicle lanes:** No change; LRT makes use of existing reserved streetcar alignment.

**Parking:** No changes identified.
















































**Intersections:** No changes identified.































# Evaluation Summary






A Multiple Account Evaluation considered a range of costs, benefits and impacts of the alternatives relative to "business as usual."

 Very Poor
  Poor
  Neutral
  Good
  Very Good

ACCOUNT	CRITERIA CONSIDERED	BEST BUS	BRT Diesel/Trolley	LRT 1 Option A/Option B	LRT 2 Option A/Option B	RRT Option A/Option B	COMBO 1	COMBO 2
Economic Development	Construction Effects, Tax Effects, Goods Movement							
Environment	Emissions Reduction, Noise and Vibration, Biodiversity, Water Environment, Parks and Open Space		 / 			 / 		
Financial	Capital Cost, Operating Cost, Cost Effectiveness			 / 		 / 		
Social and Community	Health Effects, Low Income Population Served, Safety, Community Cohesion, Heritage and Archaeology					 / 		
Transportation	Transit Users, Non-Transit Users, Transit Network/System Access, Reliability, Capacity and Expandability							
Urban Development	Land Use Integration, Land Use Potential, Property Requirements, Urban Design Potential							
Deliverability	Constructability, Acceptability, Funding and Affordability	TBD	TBD	TBD	TBD	TBD	TBD	TBD

# Economic Development

CRITERIA CONSIDERED	BEST BUS	BRT Diesel / Trolley	LRT 1 Option A / Option B	LRT 2 Option A / Option B	RRT Option A / Option B	COMBO 1	COMBO 2
Construction Effects							
Tax Effects							
Goods movement							
Summary Score							

 Very Poor
  Poor
  Neutral
  Good
  Very Good

# Environment

CRITERIA CONSIDERED	BEST BUS	BRT Diesel / Trolley	LRT 1 Option A / Option B	LRT 2 Option A / Option B	RRT Option A / Option B	COMBO 1	COMBO 2
Emissions Reductions (mega-tonnes GHG over 30 years)	-19	Diesel: 110 Trolley: 252	A: 185 B: 214	A: 184 B: 180	A: 52 B: 316	295	183
Noise and Vibration							
Biodiversity							
Water Environment							
Parks & Open Space							
Summary Score							

Very Poor




































Poor






Neutral

Good













































Very Good

# Financial

CRITERIA CONSIDERED	BEST BUS	BRT Diesel / Trolley	LRT 1 Option A / Option B	LRT 2 Option A / Option B	RRT Option A / Option B	COMBO 1	COMBO 2
Capital Cost							
Operating Cost			 / 	 / 	 / 		
Cost Effectiveness			 / 		 / 		
Summary Score			 / 		 / 		

 Very Poor
  Poor
  Neutral
  Good
  Very Good

# Social and Community

CRITERIA CONSIDERED	BEST BUS	BRT Diesel / Trolley	LRT 1 Option A / Option B	LRT 2 Option A / Option B	RRT Option A / Option B	COMBO 1	COMBO 2
Health Effects					 / 		
Low Income Population Served							
Safety							
Community Cohesion							
Heritage and Archaeology							
Summary Score					 / 		

 Very Poor

 Poor













































 Neutral

 Good

 Very Good



# Transportation

CRITERIA CONSIDERED	BEST BUS	BRT Diesel / Trolley	LRT 1 Option A / Option B	LRT 2 Option A / Option B	RRT Option A / Option B	COMBO 1	COMBO 2
Transit Users					 / 		
Non-Transit Users					 / 		
Transit Network/ System Access							
Reliability							
Capacity and Expandability							
Summary Score							

 Very Poor







































 Poor

 Neutral

 Good

 Very Good

# Urban Development

CRITERIA CONSIDERED	BEST BUS	BRT Diesel / Trolley	LRT 1 Option A / Option B	LRT 2 Option A / Option B	RRT Option A / Option B	COMBO 1	COMBO 2
Land Use Integration			 / 	 / 	 / 		
Land Use Potential							
Property Requirements							
Urban Design Potential							
Summary Score							

 Very Poor















 Poor






 Neutral

 Good

 Very Good

# Deliverability

CRITERIA CONSIDERED	BEST BUS	BRT Diesel / Trolley	LRT 1 Option A / Option B	LRT 2 Option A / Option B	RRT Option A / Option B	COMBO 1	COMBO 2
Constructability							
Acceptability	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Funding and Affordability							

 Very Poor       Poor       Neutral       Good       Very Good