Population & Employment Catchment of Proposed Rapid Transit
Comparison of North Shore-Burnaby & Broadway (Arbutus-UBC) Corridors

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Overview

• Regional Traffic Choke Points vs Recent Transit Plans and Costs
• Comparison of Recent Canadian Rapid Transit Projects and Costs
• Cheaper alternatives for Broadway SkyTrain and Surrey SkyTrain
• North Shore to Burnaby Light Rail – Background
• Study Methodology and Objectives
• Preliminary Findings for Proposed North Shore to Burnaby LRT corridor
Regional Traffic Choke Points vs Recent Transit Plans & Costs
$2.9B Subway

$1.6B LRT

$1.9B LRT

TOTAL PRICE $6.5 B
$7B Subway
$2.9B SkyTrain
$1.6B LRT (Ph 2)

TOTAL PRICE $11.5 B
McCallum-Stewart Plan does not address major regional traffic choke points; worsens Expo Line capacity issues.
## TransLink’s Phase 2 Capital Plan

<table>
<thead>
<tr>
<th>Project Description</th>
<th>Cost (2018 Plan)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning of Phase 2 Surrey LRT &amp; Broadway subway</td>
<td>$36 million</td>
<td>(0.4%)</td>
</tr>
<tr>
<td>Roads/Cycling</td>
<td>$125 million</td>
<td>(1.8%)</td>
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<tr>
<td>New Buses</td>
<td>$530 million</td>
<td>(8.1%)</td>
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<tr>
<td>New SkyTrain cars (203 vehicles)</td>
<td>$1.3 billion</td>
<td>(20.1%)</td>
</tr>
<tr>
<td>Surrey LRT – Phase 1 (Newton-Guildford: 10.5km)</td>
<td>$1.65 billion</td>
<td>(25.6%)</td>
</tr>
<tr>
<td>Broadway Subway – Phase 1 (Clark-Arbutus: 5.7km)</td>
<td>$2.83 billion</td>
<td>(44.0%)</td>
</tr>
<tr>
<td><strong>Total Capital Costs (2018 Plan)</strong></td>
<td>$6.41 Billion</td>
<td></td>
</tr>
<tr>
<td>Stewart-McCallum Plan (2019) (28.7km, excluding Newton-Guildford line)</td>
<td>$11.9 billion</td>
<td>(+85.6%)</td>
</tr>
</tbody>
</table>

* 70% of ten-year budget (2018) devoted to only 16.2km of rail in Surrey & Vancouver (now 83% for 23km)
** No funding allocated to North Shore rapid transit planning (should be on equal footing with Surrey/Broadway)
Comparison of Recent Rapid Transit Projects & Costs
# Technologies and Costs – Recent Canadian Projects

**SURFACE LRT (Exclusive ROW; no/minimal grade separation)** (Canada avg: $97M/km) (USA avg: C$42M: Cervero 2011)

- 19km Waterloo (Ontario) LRT (2018) - $868 million (no grade separation) ($45M/km)
- 11km Toronto LRT: Finch West (2023) - $1.2 billion (10% tunnel/frwy bridge crossing) ($109M/km)
- 13km Edmonton LRT: Valley Line SE (2020) – $1.8 billion (20% river bridge/tunnel/elevated) ($138M/km)
- 10.5km Surrey LRT: Guildford-Newton (2024) - $1.65 billion (no grade separation) ($157M/km)

**Grade Separated LRT/Light Metro (Significant Grade Separation)** (Canada avg: $142M/km)

- 19km Canada Line (2009) - $2.0 billion (fully grade separated, 9km tunnel & bridge) ($105M/km)
- 67 km Reseau Expr. Metro (Montreal) (2018) - $6.3 billion (fully grade separated) ($106M/km)
- 11km Evergreen Line (2016) - $1.4 billion (fully grade separated, 2km bored tunnel) ($127M/km)
- 12.5 km Confederation Line (Ottawa) (2018) - $2.1 billion (fully grade separated) ($168M/km)
- 8.2km Calgary West LRT (2013) - $1.4 billion (mostly grade separated) ($170M/km)
- 19km Eglinton LRT (Toronto) (2021) - $1.4 billion (half in bored tunnel) ($278M/km)

**SUBWAY/METRO (Underground)** (Canada avg: $274M/km) (USA avg: C$180M incl ALRT – from Cervero 2011)

- 5.2km Orange Line Laval Ext (Montreal) (2007) - $745 million (long 150m stations) ($135M/km)
- 8.6km Spadina Line Extension to Vaughan (Toronto) (2017) - $3.2 billion ($372M/km)
- 5.7km Broadway M-Line Extension: VCC-Arbutus (2025) - $2.83 billion ($497M/km)
Technologies and Costs – USA/Canada Averages


AVERAGE COST: (Canada – Recent Systems) LRT: mostly surface C$ 97M/km Light Metro: mostly elevated C$ 142M/km Subway: mostly underground C$ 274M/km
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Cheaper Alternatives for Broadway & Surrey SkyTrain Projects
Alternative 1: Millennium Line to Downtown/N. Shore

Cut Phase 1 at Granville-Broadway; Phase 2 via high traffic Granville Island & Thurlow St to West End and eventually **Phase 3 to North Shore - instead of UBC**

- Millennium Line demand focus is downtown; Expo Line can’t handle demand from Commercial-Downtown in 15 years
- Gives flexibility for Phase 2 and cuts 1.2km from route (saving $600M) and allows for LRT to UBC
Alternative 2: Broadway SkyTrain Cheaper Routing: Phase 1

- Potential cost savings up to 60% with cut & cover on 6th Ave vs bored tunnel (Broadway) - yet only 3 blocks away (save $billions)

- 6th Avenue & adjacent rail RoW allows cut & cover construction at fraction of cost (relatively few businesses)
- Hillside escalator at Oak reduces travel time of 3 blocks to Broadway (Cambie/Granville served by frequent bus/train)
- Cost savings massive ($350 M less/km if similar to Canada Line + inflation) yet only 3 blocks from Broadway
Alternative 3: Surrey-Langley SkyTrain Cost Reduction

• Current TransLink estimate is $2.9 billion for 16km as Expo Line extension ($181M/km)

• If LRT is abandoned - switch to Canada Line technology (up to 40% cheaper due to shorter stations, alternative vehicle technology and strategic single tracking)

• Potential cost reduction to ~$1.74 billion with no change to level of service, ample capacity for future demand, and cheaper future extension options
North Shore to Burnaby Light Rail Concept - Background
North Shore Transportation Conditions - Background

- **Ironworkers Bridge**: critical regional connector without strong transit links:
  - Significant worsening of 2 way congestion due to employment growth, higher truck movements and additional regional traffic, among other reasons
  - Modest growth of transit capacity, but minimal travel time improvement - not a reasonable option for users travelling between North Shore & eastern suburbs)
    - Travel time across North Shore often exceeds 45 minutes (peak) and requires transfer
    - Transfer required to leave North Shore (at Phibbs), and another transfer to SkyTrain
    - Port Coquitlam to Harbourside: 3 buses+1 SkyTrain = 2 hours (each way)
    - Langley to Maplewood: 1 SkyTrain, 3 buses = 2 hours
- Most leisure trips to the North Shore occur by car because of poor transit access - growth of off-peak traffic congestion in recent years
Conditions for North Shore to Burnaby Light Rail

• Significant congestion at bridgeheads & east-west movements makes high quality transit alternative attractive for a large number of car users (mode shift if easy)
• Dense hubs & growth centres lined up in east-west trajectory across North Shore, thus serving places where most new development will happen (shape growth)
• Vast majority of North Shore jobs are within a 5 min walk of the corridor
• Only one logical transit corridor across North Shore, therefore nearly all transit growth will occur on a single rapid transit line (unlike UBC’s many bus corridors)
• East-west corridor mostly flat, and Marine cross section could handle LRT with modest traffic impact if Low Road extension from Garden to Park Royal built
• Light rail offers flexibility and reduces costs - mostly at surface, but strategically grade-separated east of St Davids (SkyTrain requires full grade separation/tunnels)
North Shore to Burnaby Alignment

• **MARINE DRIVE AT-GRADe SEGMENT:** 22nd Station in Ambleside to Capilano Mall Station along Marine Drive; stations at 15th, Park Royal, Capilano & Pemberton
  ➢ Low Road becomes 4 lanes east of Garden; new Low Road Ext west of Garden to Park Royal

• **HARBOURSIDE-ESPLANADE AT-GRADe SEGMENT:** South from Capilano Mall along Hanes to CN RoW with station at Fell, and then follow to Esplanade with stations at Chesterfield and St. Georges.

• **LOW LEVEL ROAD-MAIN ST SEGMENT:** Fit into Low Level Rd corridor as elevated guideway with stations at St Davids and Park & Tilford; then fit into CN RoW as guideway to Phibbs Station (highest speeds achieved in this segment)

• **PHIBBS-BRENTWOOD SEGMENT:** Continue east at-grade/elevated to Maplewood Stn, then south to new bridge and Hastings & Willingdon at-grade alignment: stations at West Coast Express-PNE, Boundary, Gilmore, Willingdon & Brentwood

• Alternate alignment options on MacKay / 3rd St (CNV) / Boundary-Lougheed (Bby)
Proposed 11.5km North Shore Light Rail

- Higher potential for new riders/travel time savings than Surrey/Broadway
- Rapid alternative to bridge bottlenecks with no-transfer link from SkyTrain
- Most N. Shore jobs within 400m of corridor but workforce mostly S of Inlet
North Shore Light Rail Accessibility Benefits

- West Vancouver to Burnaby LRT would serve key transfer hubs at Park Royal, Lonsdale Quay, Phibbs Exchange, West Coast Express, Hastings & Millennium Line
- Only 1 transfer required between North Shore jobs & all locations on West Coast Express & Millennium Line (eventually to Expo Line at Metrotown in later phase)
- Port Coquitlam-Harbourside: 45 mins via WCE/LRT (time savings: 2h30m /day)
- Langley-Maplewood: 55 mins via SkyTrain/LRT (time savings: 2h10m /day)
- Ambleside to Brentwood: 28-29 mins  Ambleside to Phibbs: 19-20 mins

* LRT Travel times are estimates based on average speeds associated with LRT at 1km+ station spacing, driver control of signals at key intersections, and strategic grade separation (as contemplated east of St Davids)
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North Shore Light Rail Concept – Methodology
Study Objectives

• **Catch Up:** match catchment area work already done on competing projects (Surrey/Broadway)

• **Performance-based investment:** identify projects having highest impact for each tax dollar spent

• **Comparison** - objectively assess catchment areas (greatest source of demand) of North Shore-Brentwood corridor vs Broadway: Arbutus-UBC vs Surrey: Newton-Guildford (apples vs apples)

• **Assumptions:** (1) bridge at 2nd Narrows; (2) logical, direct, dense alignment (B-Line route with minor aberrations); (3) Burnaby segment follows highest jobs & population areas to Brentwood

• **Performance** - Accepted density thresholds for combined residents & jobs:
  
  **LRT:** 14-30 persons & jobs per acre (pja) and **Metro:** 27-50/pja
  
  (from Cervero & Guerra 2011 and Pushkarev & Zupan 1977)

• **Future population & employment** based on allowable development in Current Plans

• **Objective assessment** of suitable **supply options**
Methodology

• Data based on **400m catchment zone** around corridors: highest walk-up influence

• Corridors based on **B-Line routings and tweaked** for maximum densities, hub connections & avoiding grade separation (minor, but important aberrations from B-Line)

• Residential data obtained from 2016 Canadian census

• Multifaceted approach used to obtain **employment data**: Simply Analytics, Chamber of Commerce, and direct contact with businesses
• “Urban Densities and Transit: A Multi-dimensional perspective”
• Examined 23 light and heavy rail systems, including 768 station areas (N. America)
• Population & jobs per acre (pja) as density measure for generating ridership to support various rapid transit technologies (and their capacity/cost)
• Low end (14 pja) required to justify a basic surface LRT system without add-ons
• High end (30 pja) associated with add-ons (ie. some grade separation, more vehicles) & top 25% performance
• Ridership drops off significantly beyond 400m (5 min) catchment for employment; double dip drop off at 400m (more) & 800m (less) for residential
• Rapid transit investment in areas with high job levels rendered better performance outcomes than residential dominant areas (ideal is balance of the two)
An Academic Case for Light Rail

  - **Permanence of rail**, improved accessibility & reliability leads to confidence in larger, mixed use developments with less parking, among developers/planners
  - User appeal for rail – perceived as more reliable and comfortable than bus
- Guthrie and Fan (2015) – developers’ perspective on rapid transit & TOD
  - Perception of comfort and convenience with rail (positive image)
  - Minneapolis developers: LRT is a highly attractive development ‘pull’ factor
  - Scale and complexity of development reduced with BRT
- Waterloo LRT: attracted $3B of catchment area development before 2018 opening
- Cervero (2011) - Critical of high cost Metro systems in Miami, Atlanta & Baltimore, serving an avg of 20 persons/acre with little redevelopment since construction
North Shore to Burnaby LRT Concept – Preliminary Findings for Population & Employment Catchment Areas in Corridor

* THESE ARE PRELIMINARY POPULATION & EMPLOYMENT FINDINGS FOR THE NORTH SHORE SEGMENTS ONLY
Total figures provided are preliminary, and do not include the Phibbs to Brentwood segment. Detailed current & future employment totals, and concentration maps & population data for 9 route segments between West Vancouver to Burnaby will be released at a later date.
Current Population and Employment - with Students
Comparison of Broadway: Arbutus-UBC, Newton-Guildford & North Shore Corridors

Current Population and Employment by Corridor
Including FTE Students and extended catchment area at UBC & Lonsdale

* Surrey figures are for 2024

** Excludes Phibbs to Brentwood segment

400m Radius – Main Catchment Area for Rapid Transit Corridors (with extended catchment area at UBC & Lonsdale)
Ambleside-Cap U. – 11.5km
Newton-Guildford - 10.5km
Broadway: Arbutus-UBC - 7km
Current Population and Employment - **without Students**
Comparison of Broadway: Arbutus-UBC, Newton-Guildford & North Shore Corridors

Strict 400m Radius for Entire Corridor – No extended catchment at UBC (Students generally don’t represent new riders)

* Surrey figures for 2024  
** North Shore workforce mostly from south/east of 2nd Narrows - high potential for new riders  
*** Excludes Phibbs to Brentwood segment
Current Densities: North Shore & Broadway: Arbutus-UBC

Current Population & Employment Density: Strict 400m radius - No Students

- Broadway: Arbutus-UBC
- Ambleside-Cap U
- Lonsdale: Harbour to Hwy 1

**Current east-west densities on North Shore justify light rail system; Arbutus to UBC suited for LRT, not subway**

**Lonsdale could justify eventual Metro extension (ie. Millennium Line from Broadway to Downtown to Lonsdale)**
CONCLUSIONS – North Shore to Burnaby LRT

• North Shore to Burnaby corridor serves a far greater catchment of population and jobs than either the Arbutus to UBC or Surrey corridors
• North Shore corridor has a jobs-housing balance generating strong two-way flows
• Every segment of North Shore corridor is above the density threshold for LRT
• High potential for new riders on North Shore; UBC subway recycles existing riders
• Major travel time savings: 1 transfer connection to SkyTrain & West Coast Express
• North Shore LRT could be achieved at a much lower price (~$100M/km) than the Broadway subway ($500M/km), while providing greater overall benefits to region
• Multiple funding pools for new rail bridge (incl goods movement) would reduce cost allocated to LRT project.
Population & Employment Catchment of Proposed Rapid Transit
Comparison of North Shore-Burnaby & Broadway (Arbutus-UBC) Corridors

Final Report to be released in Spring 2019