Population & Employment Catchment of Proposed Rapid Transit

Comparison of North Shore-Burnaby & Broadway (Arbutus-UBC) Corridors

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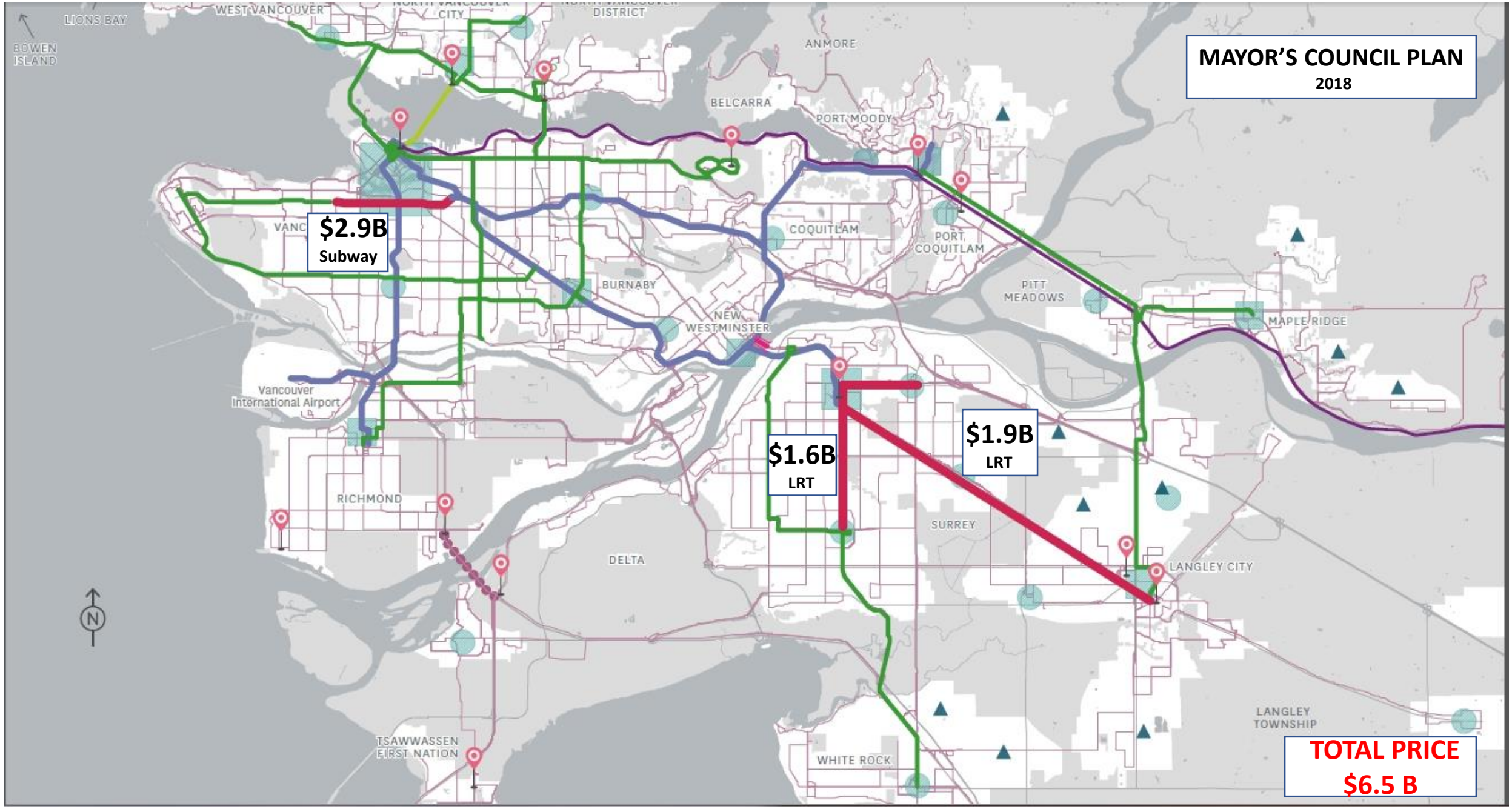
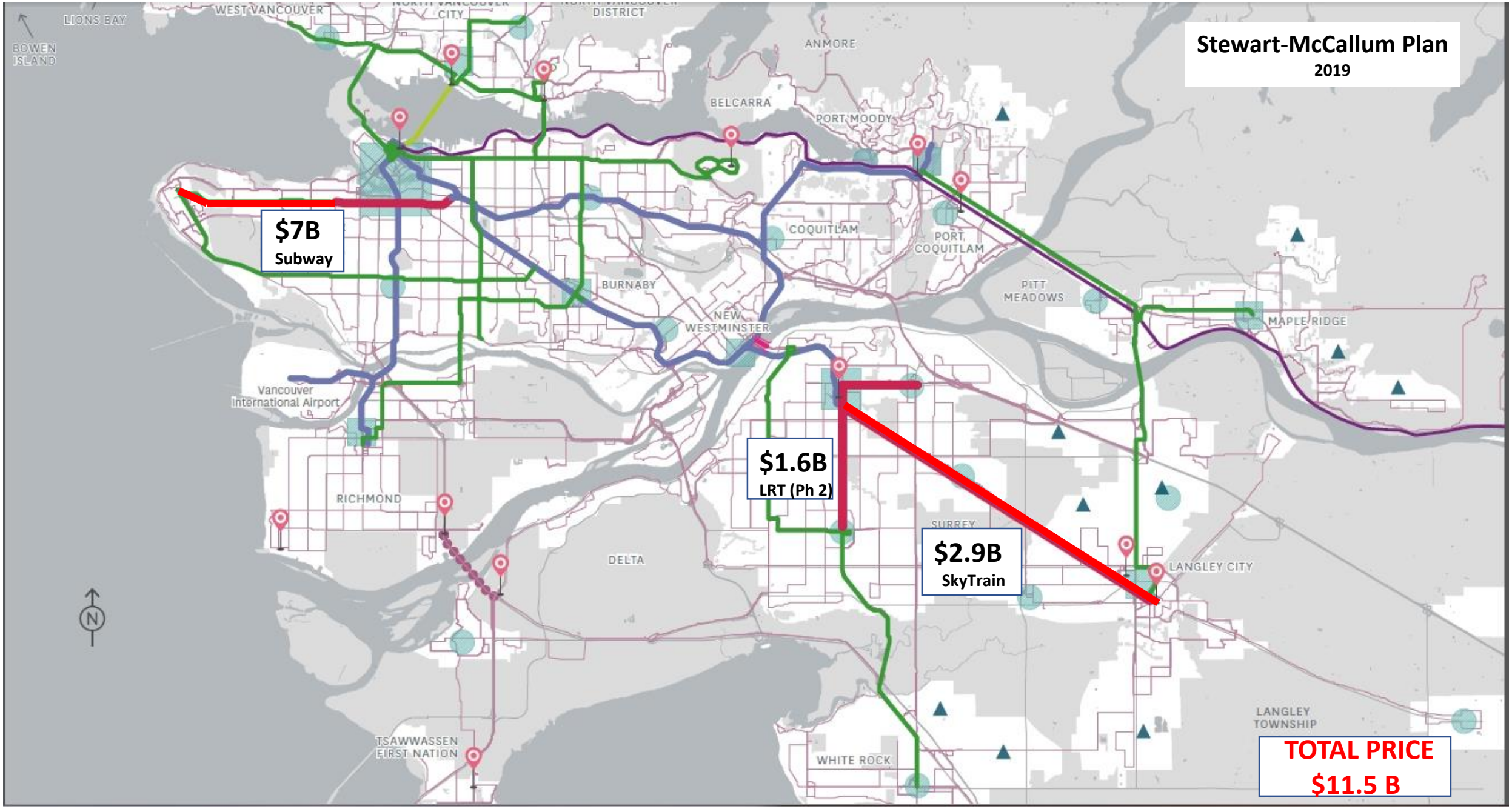
Overview

- 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

1
Regional Traffic Choke Points vs Recent Transit Plans & Costs


MAYOR'S COUNCIL PLAN
2018
$2.9B
Subway
$1.6B
LRT
$1.9B
LRT
TOTAL PRICE
$6.5 B
LIONS BAY
BOWEN ISLAND
WEST VANCOUVER
NORTH VANCOUVER CITY
NORTH VANCOUVER DISTRICT
ANMORE
BELCARRA
PORT MOODY
COQUITLAM
PORT COQUITLAM
PITT MEADOWS
MAPLE RIDGE
BURNABY
NEW WESTMINSTER
Vancouver International Airport
RICHMOND
DELTA
SURREY
LANGLEY CITY
LANGLEY TOWNSHIP
TSAWWASSEN FIRST NATION
WHITE ROCK
N


Stewart-McCallum Plan
2019
$7B
Subway
$1.6B
LRT (Ph 2)
$2.9B
SkyTrain
TOTAL PRICE
$11.5 B
LIONS BAY
BOWEN ISLAND
WEST VANCOUVER
NORTH VANCOUVER CITY
NORTH VANCOUVER DISTRICT
ANMORE
BELCARRA
PORT MOODY
COQUITLAM
PORT COQUITLAM
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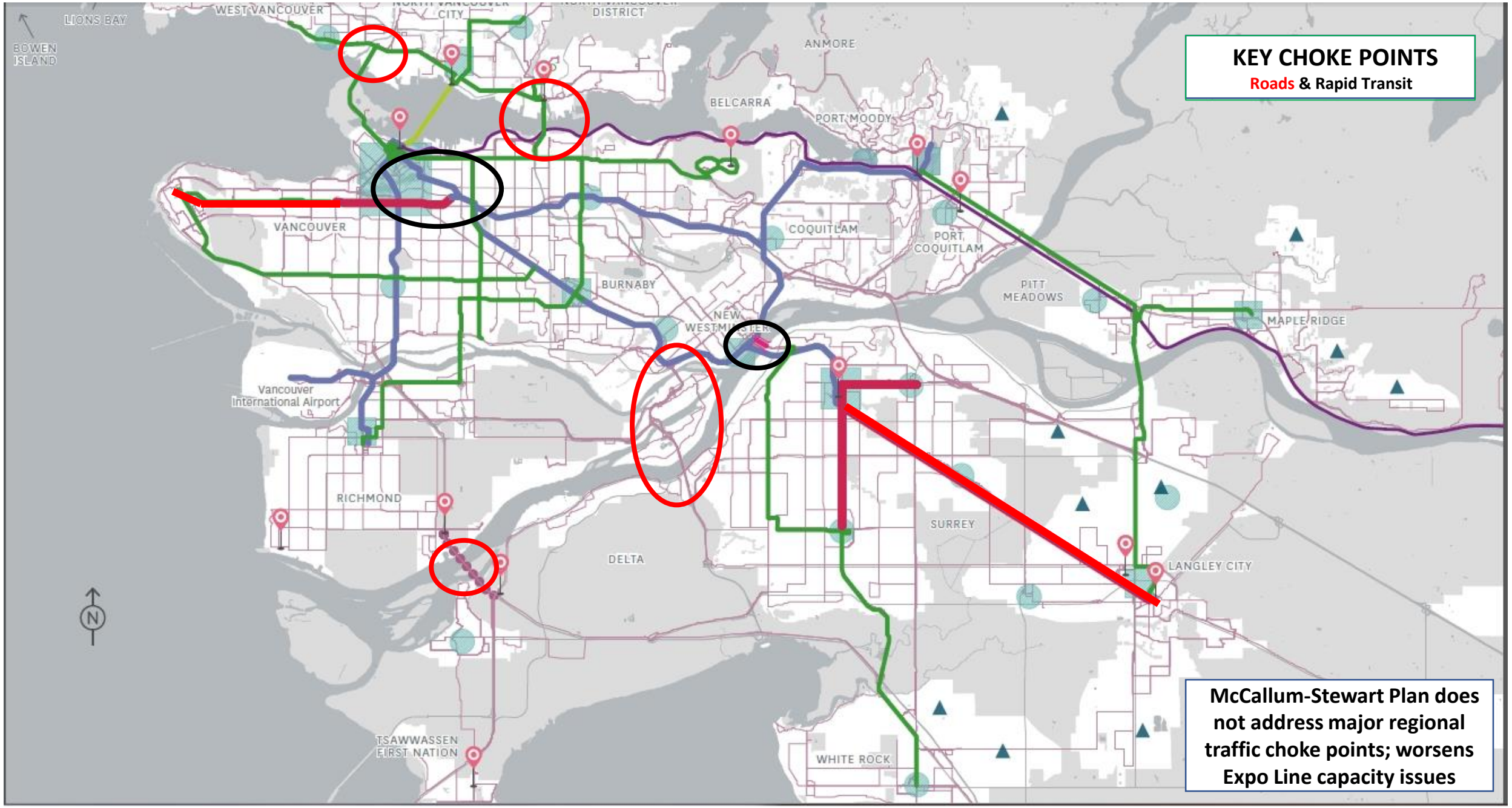
KEY CHOKE POINTS
Roads & Rapid Transit
McCallum-Stewart Plan does not address major regional traffic choke points; worsens Expo Line capacity issues
LIONS BAY
BOWEN ISLAND
WEST VANCOUVER
NORTH VANCOUVER CITY
NORTH VANCOUVER DISTRICT
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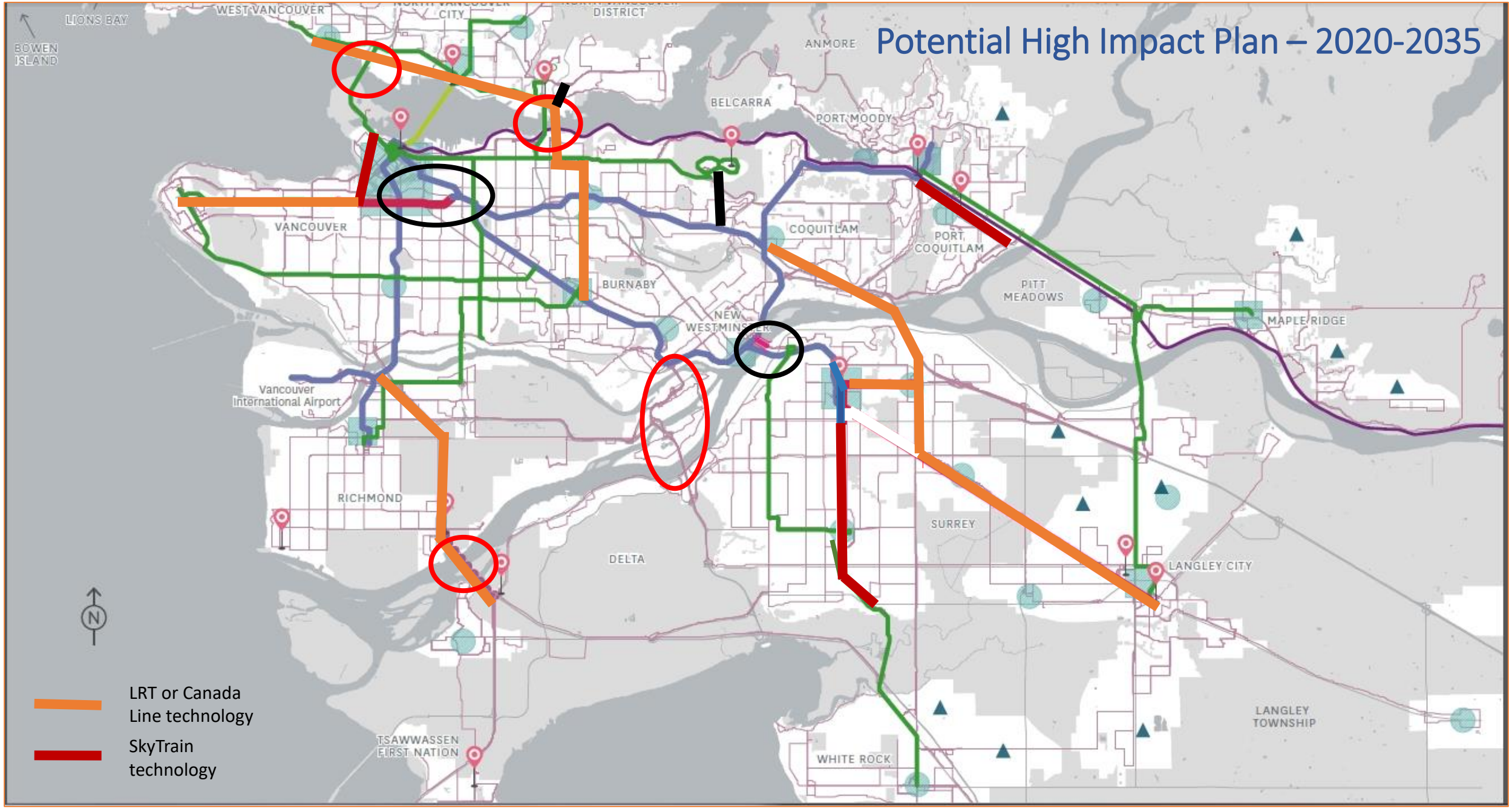
Potential High Impact Plan – 2020-2035



TransLink's Phase 2 Capital Plan

Planning of Phase 2 Surrey LRT & Broadway subway	**$36 million**	**(0.4%)**
Roads/Cycling	**$125 million**	**(1.8%)**
New Buses	**$530 million**	**(8.1%)**
New SkyTrain cars (203 vehicles)	**$1.3 billion**	**(20.1%)**
Surrey LRT – Phase 1 (Newton-Guildford: 10.5km)	**$1.65 billion**	**(25.6%)**
Broadway Subway – Phase 1 (Clark-Arbutus: 5.7km)	**$2.83 billion**	**(44.0%)**

Total Capital Costs (2018 Plan) **$6.41 Billion**

Stewart-McCallum Plan (2019) (28.7km, excluding Newton-Guildford line) **$11.9 billion (+85.6%)**

*** 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)

2
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: (USA – New-build Systems) 1970-2011: (2011$) (LRT) **C$ 42M/km**

(from Cervero 2011) (Combined Light Metro & Subway) **C$180M/km**

AVERAGE COST: (Canada – Recent Systems) LRT: mostly surface **C$ 97M/km**

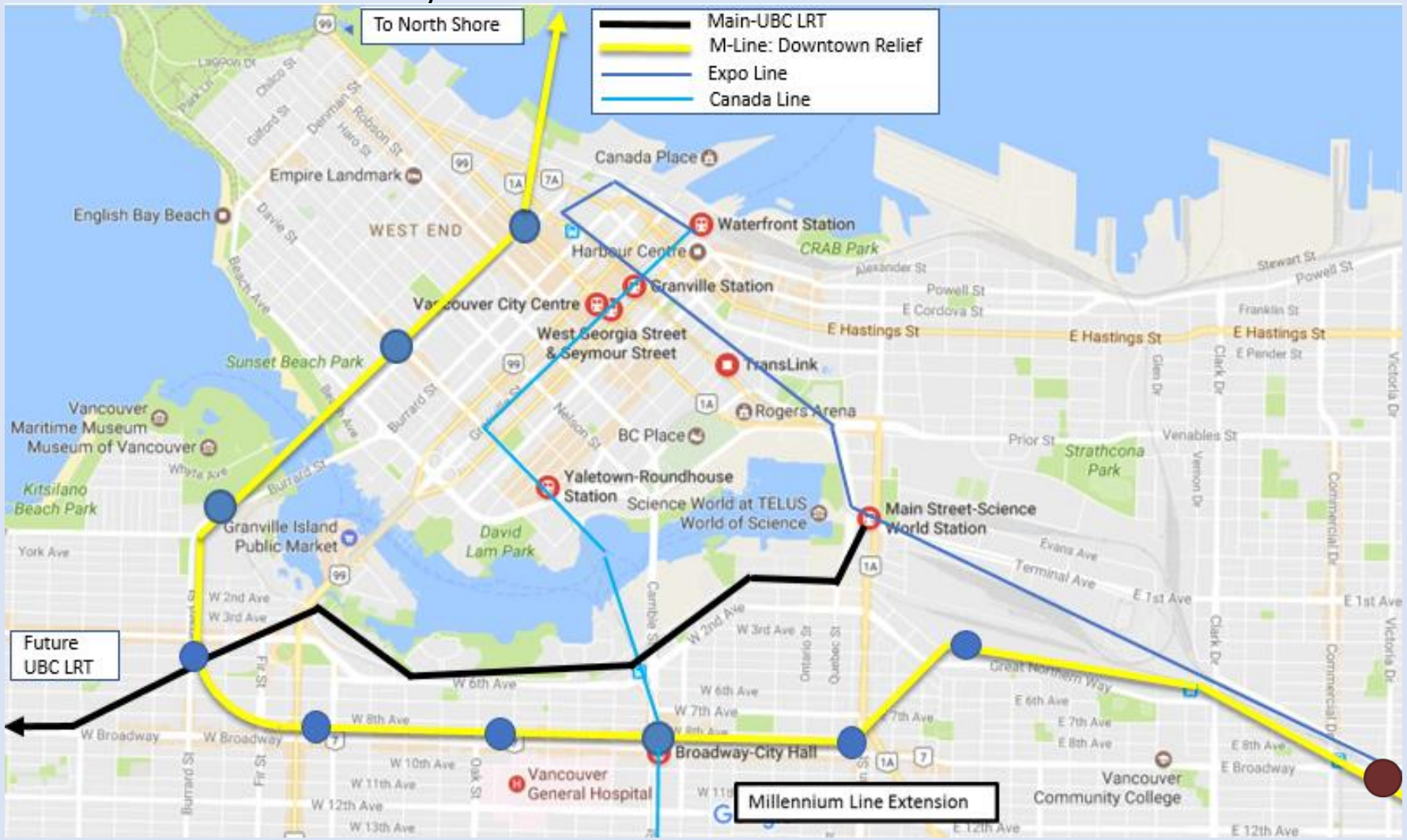
Light Metro: mostly elevated **C$ 142M/km**

Subway: mostly underground **C$ 274M/km**

3
Cheaper Alternatives for Broadway & Surrey SkyTrain Projects

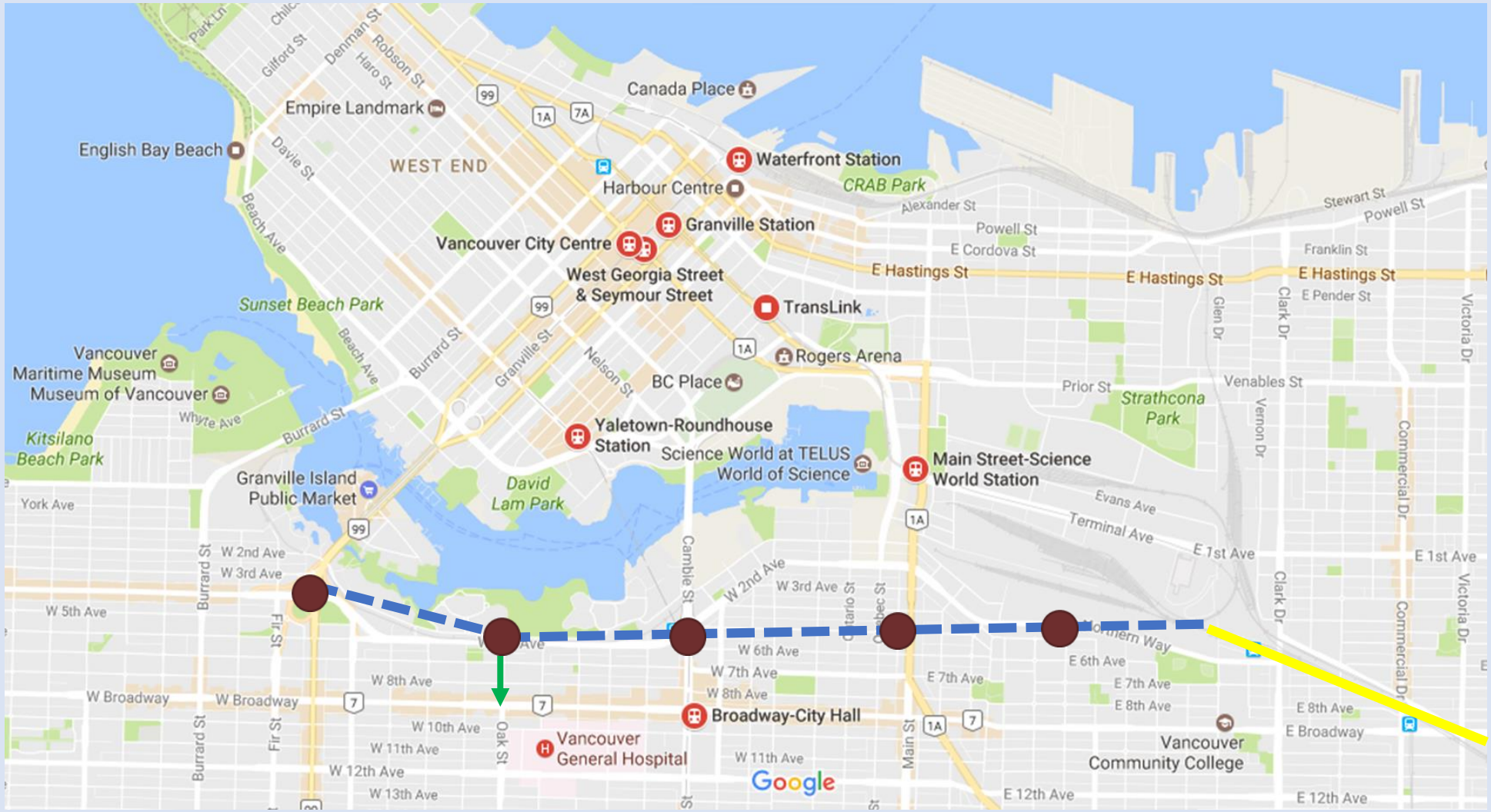
Alternative 1: Millennium Line to Downtown/N. Shore

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

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North Shore to Burnaby Light Rail Concept - Background

North Shore Transportation Conditions - Background

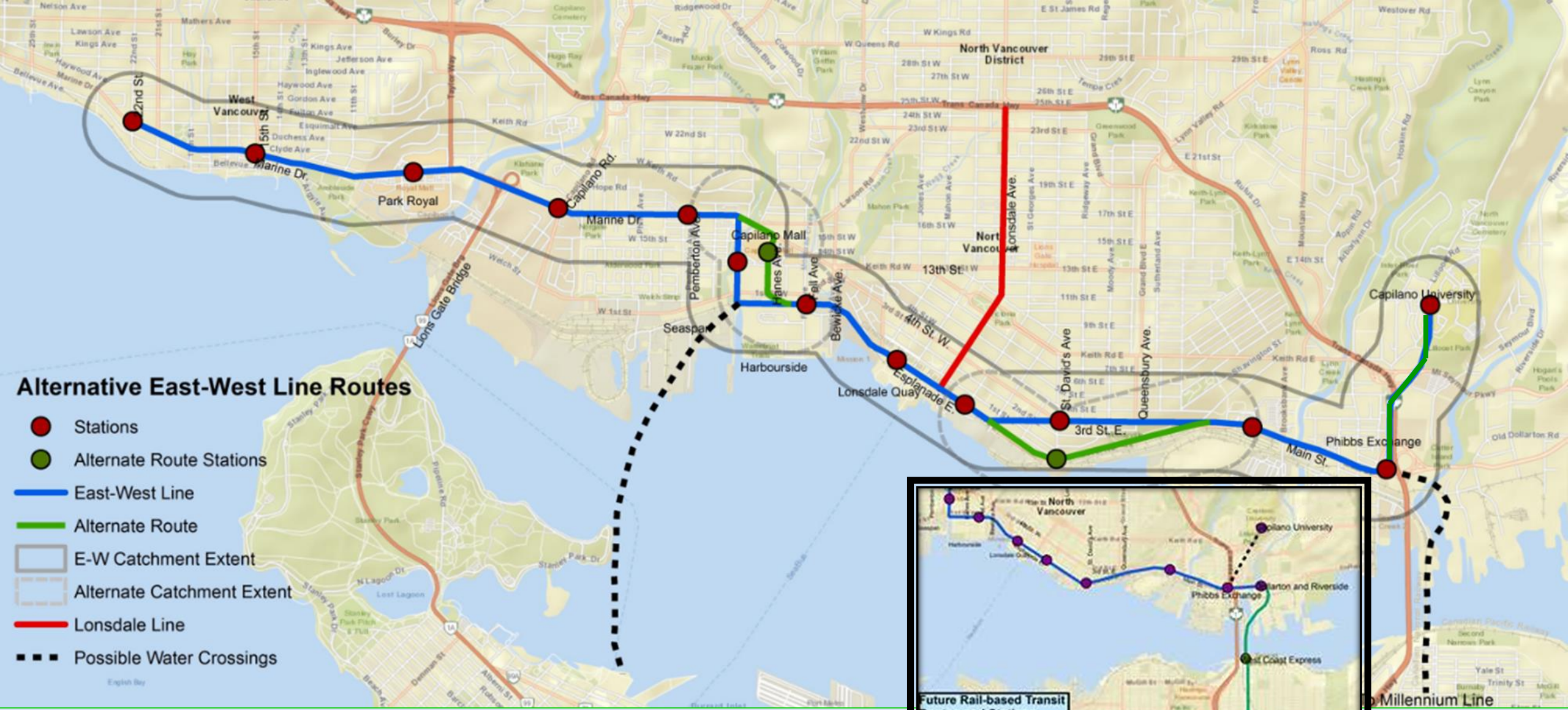
- **Ironworkers Bridge: critical regional connector without strong transit links:**
- Significant worsening of 2 way congestion due to employment growth, higher truck movements and additional regional traffic, among other reasons
- Modest growth of transit capacity, but minimal travel time improvement - 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

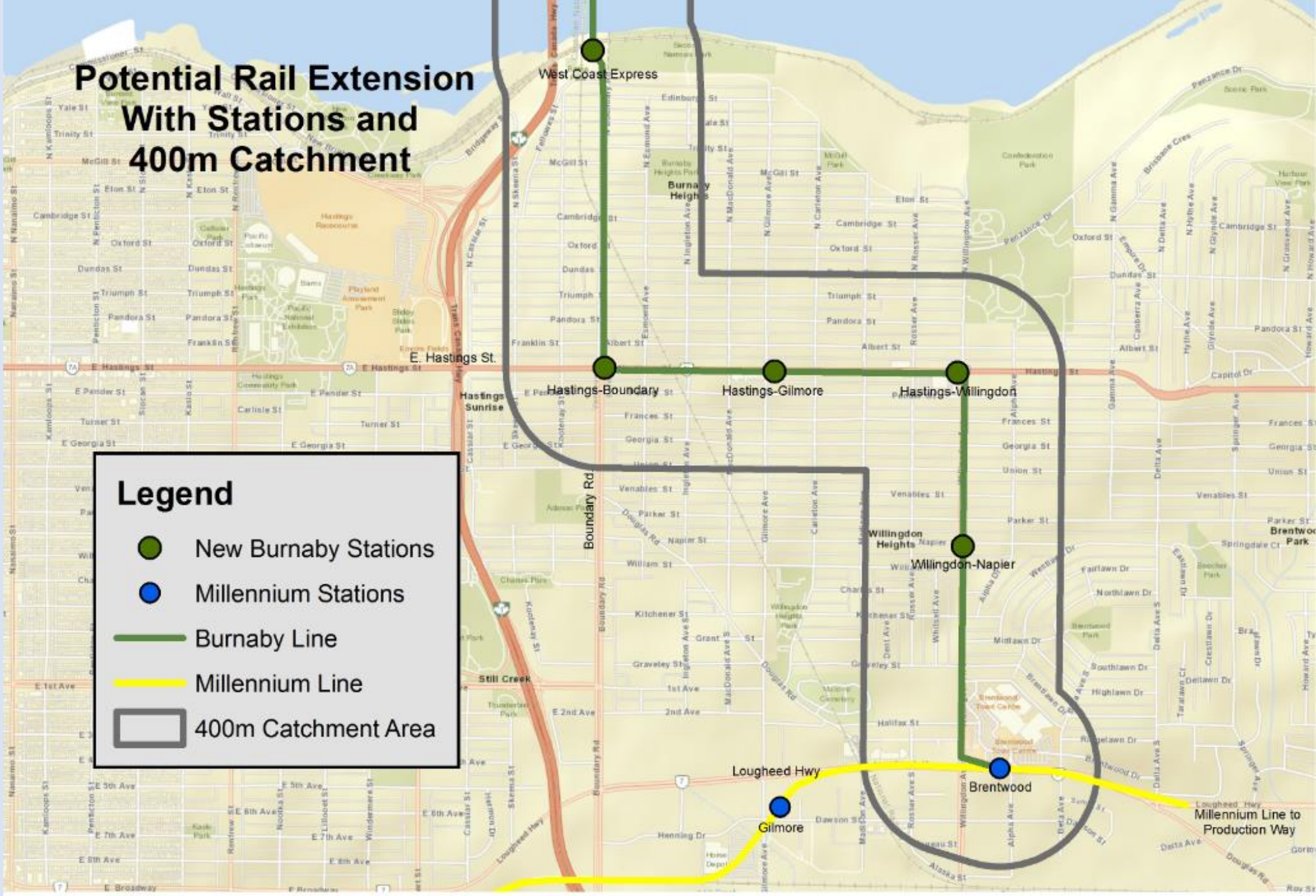
- **MARINE DRIVE AT-GRADE SEGMENT:** 22nd Station in Ambleside to Capilano Mall Station along Marine Drive; stations at 15th, Park Royal, Capilano & Pemberton
  - Low Road becomes 4 lanes east of Garden; new Low Road Ext west of Garden to Park Royal
- **HARBOURSIDE-ESPLANADE AT-GRADE SEGMENT:** South 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 <u>new</u> 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

Potential Rail Extension With Stations and 400m Catchment



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**

Key Academic Work: Cervero and Guerra (2011)

- “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

- King and Fisher (2018) – examining land use effects of light rail in San Diego
  - **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

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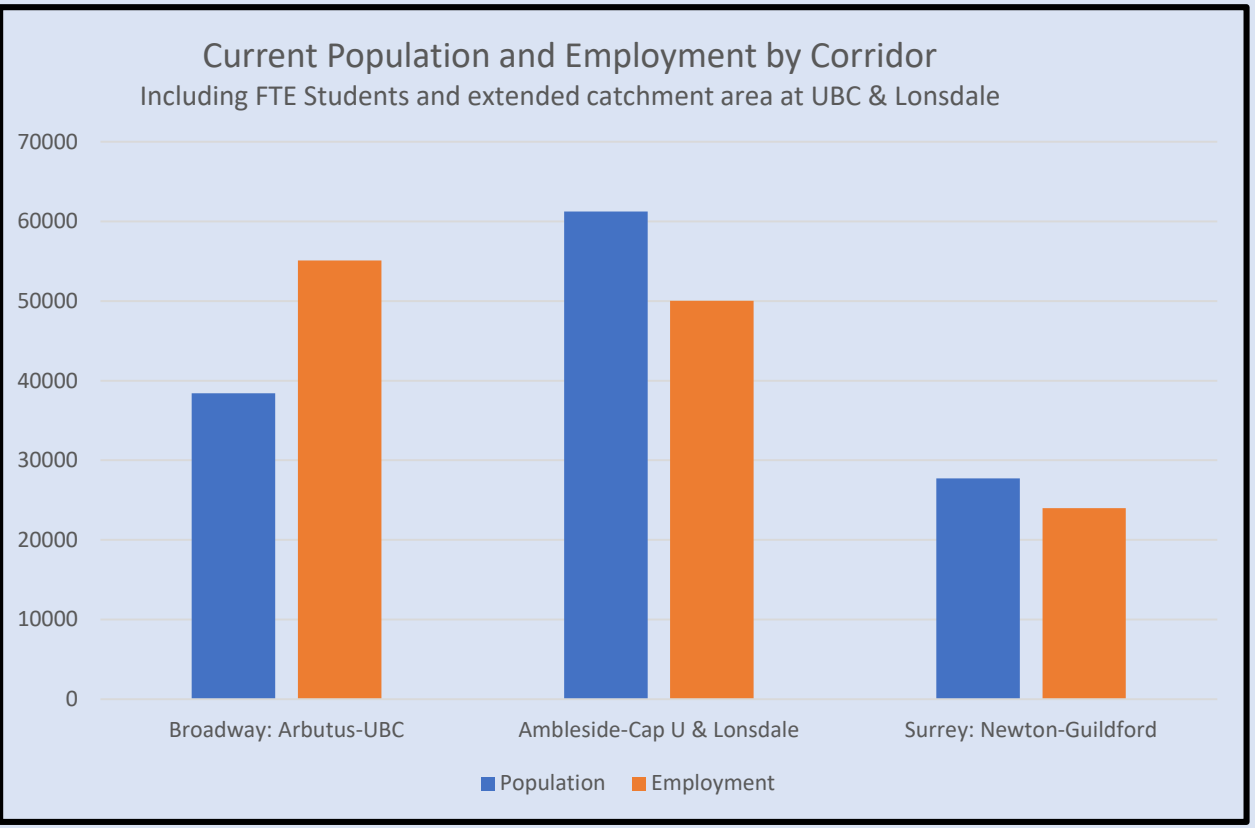
North Shore to Burnaby LRT Concept – Preliminary Findings for Population & Employment Catchment Areas in Corridor

* THESE ARE PRELIMINARY POPULATION & EMPLOYMENT FINDINGS FOR THE NORTH SHORE SEGMENTS ONLY

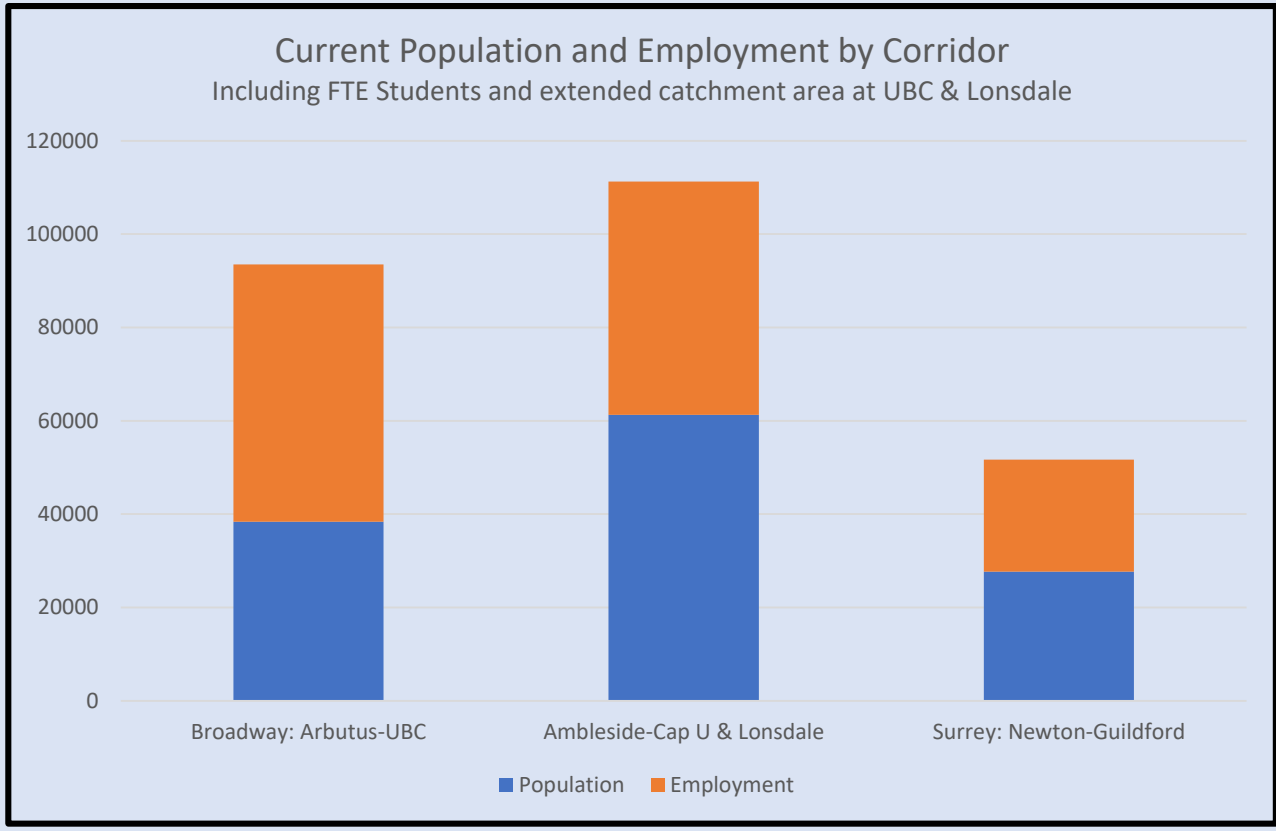
Total figures provided are preliminary, and do not include the Phibbs to Brentwood segment. Detailed current & future employment totals, and concentration maps & population data for 9 route segments between West Vancouver to Burnaby will be released at a later date.

Current Population and Employment - with Students

Comparison of Broadway: Arbutus-UBC, Newton-Guildford & North Shore Corridors



* 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)

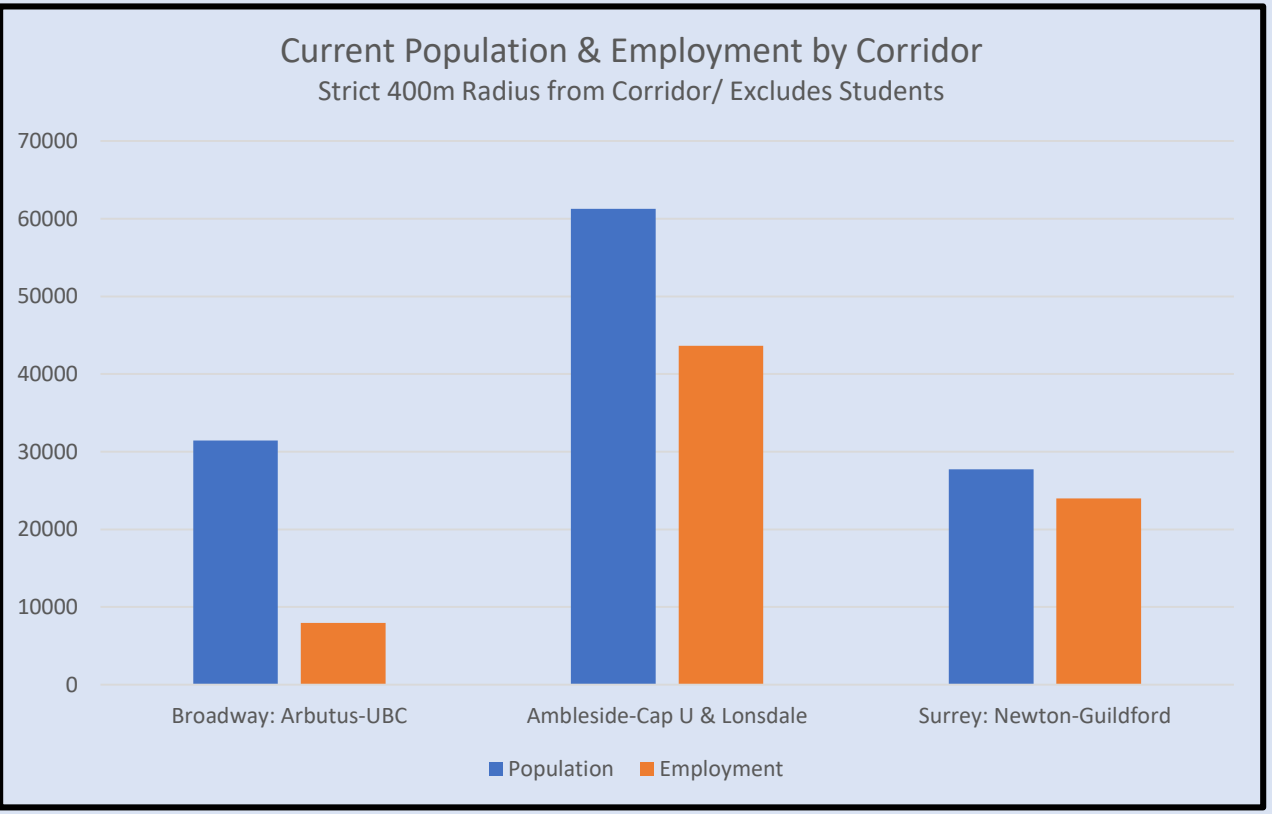
Ambleside-Cap U. – 11.5km

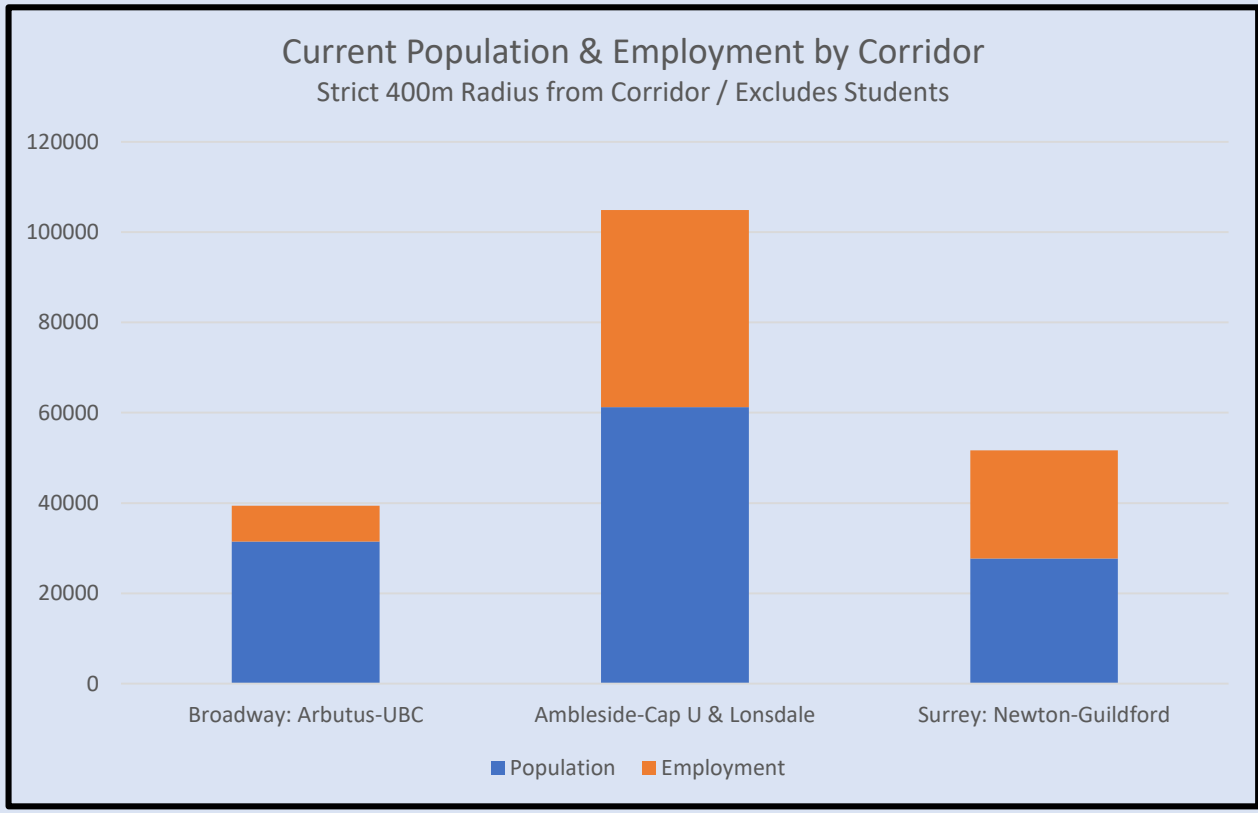
Newton-Guildford - 10.5km

Broadway: Arbutus-UBC - 7km

Current Population and Employment - without Students

Comparison of Broadway: Arbutus-UBC, Newton-Guildford & North Shore Corridors



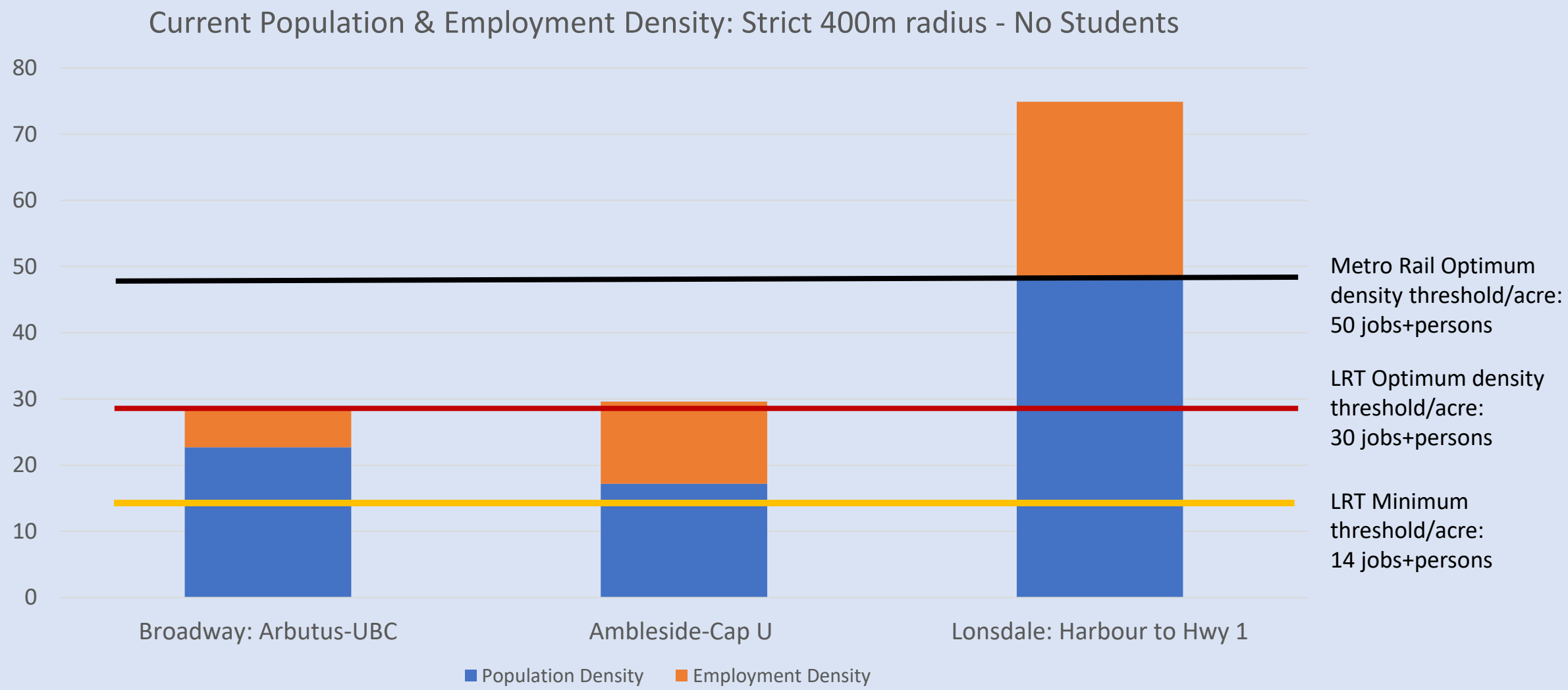


Strict 400m Radius for Entire Corridor – No extended catchment at UBC (Students generally don't represent new riders)

*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 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