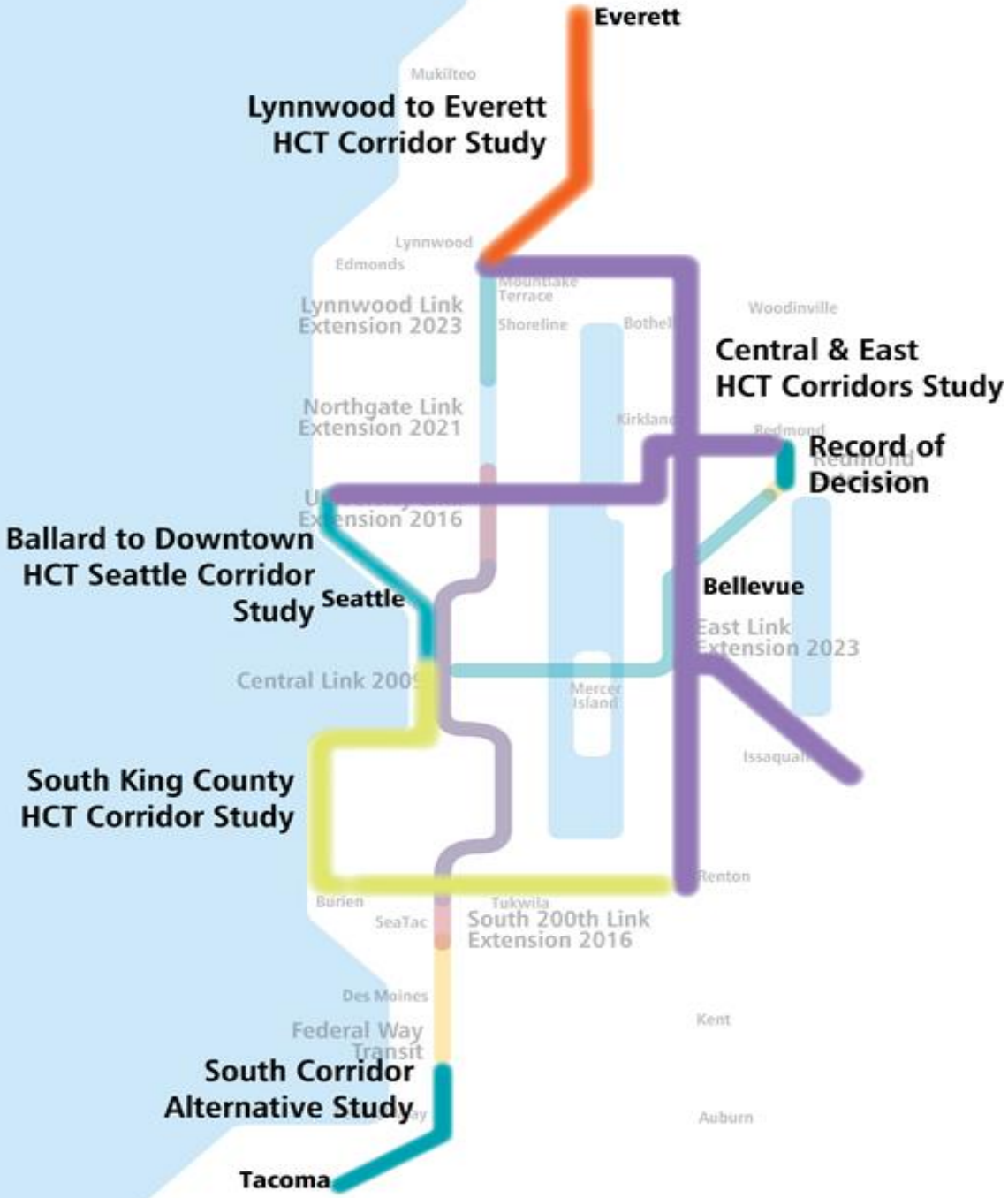
HCT Corridor Studies

Review of Corridors and Findings

SOUNDTRANSIT

May 2015


Everett
Mukilteo
Lynnwood to Everett
HCT Corridor Study
Lynnwood
Edmonds
Lynnwood Link
Extension 2023
Mountlake
Terrace
Shoreline
Bothell
Woodinville
Central & East
HCT Corridors Study
Northgate Link
Extension 2021
Kirkland
Redmond
Record of
Decision
Extension 2016
Ballard to Downtown
HCT Seattle Corridor
Study
Seattle
Bellevue
East Link
Extension 2023
Central Link 200
Mercer
Island
Issaquah
South King County
HCT Corridor Study
Renton
Burien
Tukwila
SeaTac
South 200th Link
Extension 2016
Des Moines
Federal Way
Transit
Kent
South Corridor
Alternative Study
Auburn
Tacoma

ST3 Work Elements & Timing

- **A three-step approach:**

1. HCT Corridor Studies per ST2 (2013-2014)

2. Long-Range Plan Update (unconstrained) with environmental documentation (2013-2014)

3. New Regional HCT System Plan, “ST3” (2015-2016)

High Capacity Transit Corridor Studies

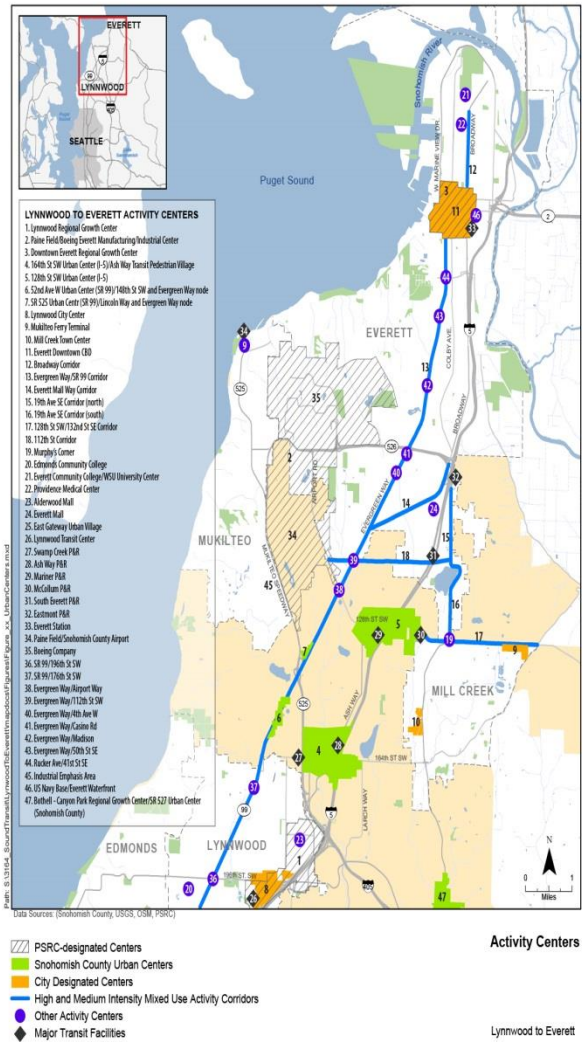
- High-level, conceptual in nature
  - Designed to provide information on possible options
  - Consistent methods across all studies for costing and ridership
  - Focused on the purpose stated in ST2
    - "Inform the Sound Transit Board's consideration of potential updates to Sound Transit's Long-Range Plan"
    - "To advance completion of further expansions of the system"
- First part of planning for potential ST3 package

Lynnwood to Everett HCT Corridor Study

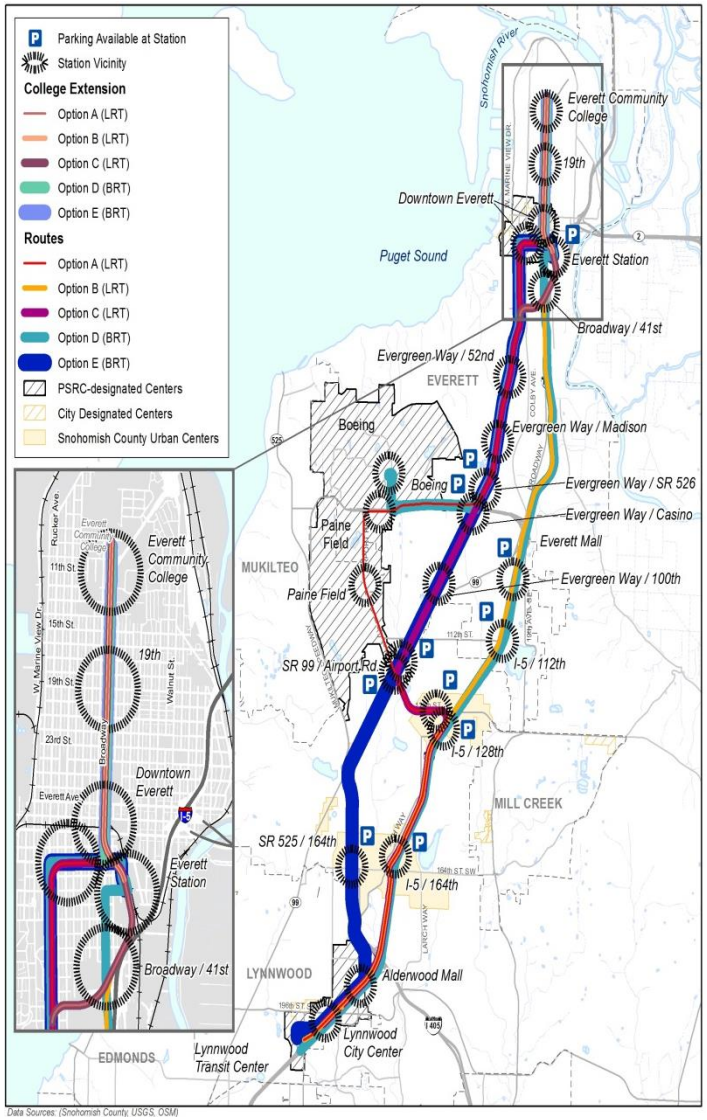
Review of General Findings

SOUNDTRANSIT

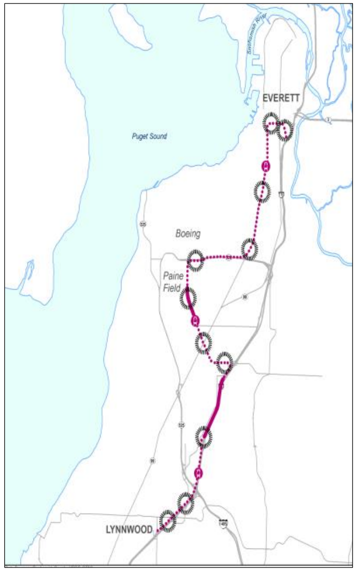
May 2015

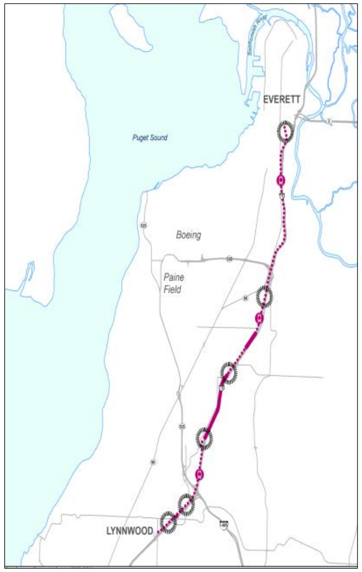


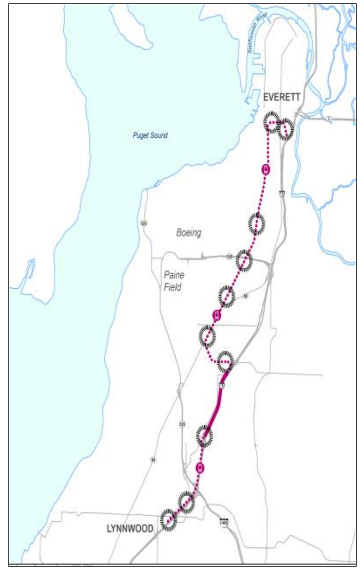
- Lynnwood to Everett Study Area
  - Part of the regional light rail “spine”
  - Three PSRC designated centers; one PSRC designated metropolitan center (Everett)
  - Congestion rapidly increasing in general purpose and HOV lanes
  - Considerable population and employment growth expected
  - Many park-and-ride lots at capacity
  - Frequent ST and Community Transit commuter service, and CT and Everett Transit local service

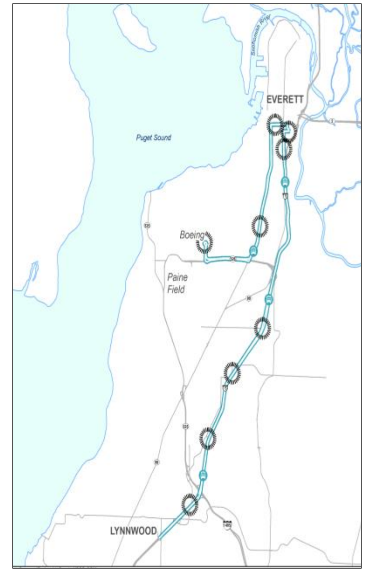


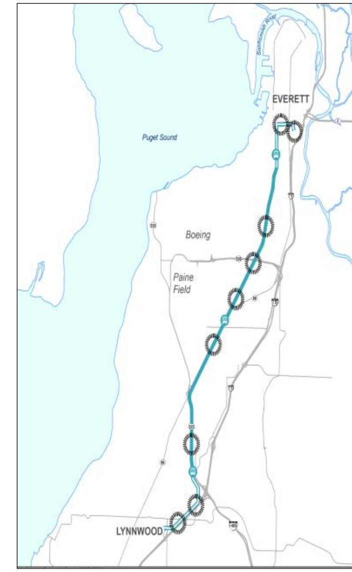
- Five options
  - 3 light rail, 2 bus
- Corridors
  - Boeing/Paine Field via I-5/SR 99
  - I-5
  - SR 99
- College Extension
  - Everett Station to Everett Community College











Option A – LRT I-5/Airport Rd/SR 526	**Option B – LRT I-5**	**Option C – LRT I-5/SR 99**	**Option D – BRT I-5/Boeing Connector**	**Option E – BRT SR 99/Evergreen Way**
15.7 miles *17.3 miles**	12.6 miles *14.8 miles**	14.0 miles *15.6 miles**	19.6 miles *23.5 miles**	13.6 miles *18.1 miles**
33 min *37 min**	22 min *29 min**	29 min *34 min**	30 min (Lynnwood-Everett) *44 min** 26 min(Everett-Boeing)	50 min *64 min**
37,000 - 50,000 daily riders *39,000 - 53,000 daily riders**	32,000 - 43,000 daily riders *35,000 - 48,000 daily riders**	36,000 - 51,000 daily riders *39,000 - 53,000 daily riders**	14,000 - 21,000 daily riders *15,000 - 23,000 daily riders**	12,000 - 18,000 daily riders *13,000 - 20,000 daily riders**
\$2,530 - \$3,420 m *\$2,760 - \$3,720 m**	\$1,690 - \$2,290 m *\$2,070 - \$2,810 m**	\$2,360 - \$3,190 m *\$2,590 - \$3,490 m**	\$190 - \$260 m *\$200 - \$270 m**	\$480 - \$650 m *\$490 - \$6600 m**

	Option A LRT on I-5/ Airport Way/ SR 526	Option B I-5 LRT	Option C LRT on I-5/ SR 99/ Evergreen Way	Option D I-5 BRT	Option E SR 99 BRT
Ridership	●	◕	●	◔	◔
Reliability	●	●	●	◔	◑
Travel Time	●	●	◕	◑	◔
Disruption to Other Modes	◕	●	◕	◕	◔
Station Area Development Potential	●	◔	◕	◕	◑
Cost	○	◑	○	●	●
Cost Effectiveness	◔	◑	◔	●	○
Complexity	◑	◕	◔	◕	◑
Environmental Effects	◑	◕	◑	◕	◑

○ ◔ ◑ ◕ ●

Lower performing → Higher performing

Level 2 Evaluation Results

General Findings

- Lynnwood to Everett is a mature transit corridor, highly congested, with considerable future growth expected
- Relatively strong project ridership potential
- LRT alignments present tradeoffs between costs, travel time, TOD potential, and centers served
- For BRT options, the I-5 BRT option is most cost effective option

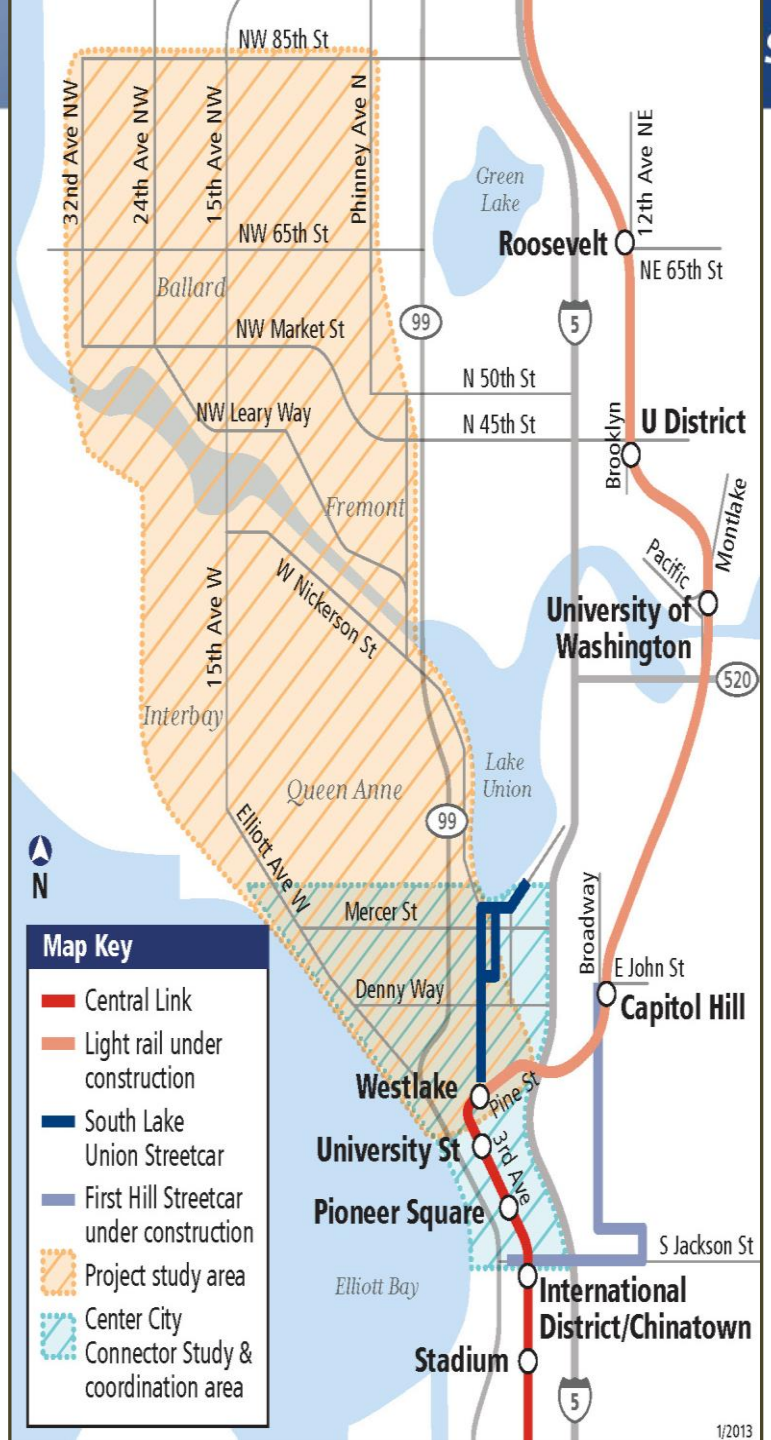
Ballard to Downtown Seattle Transit Expansion Study

Review of General Findings

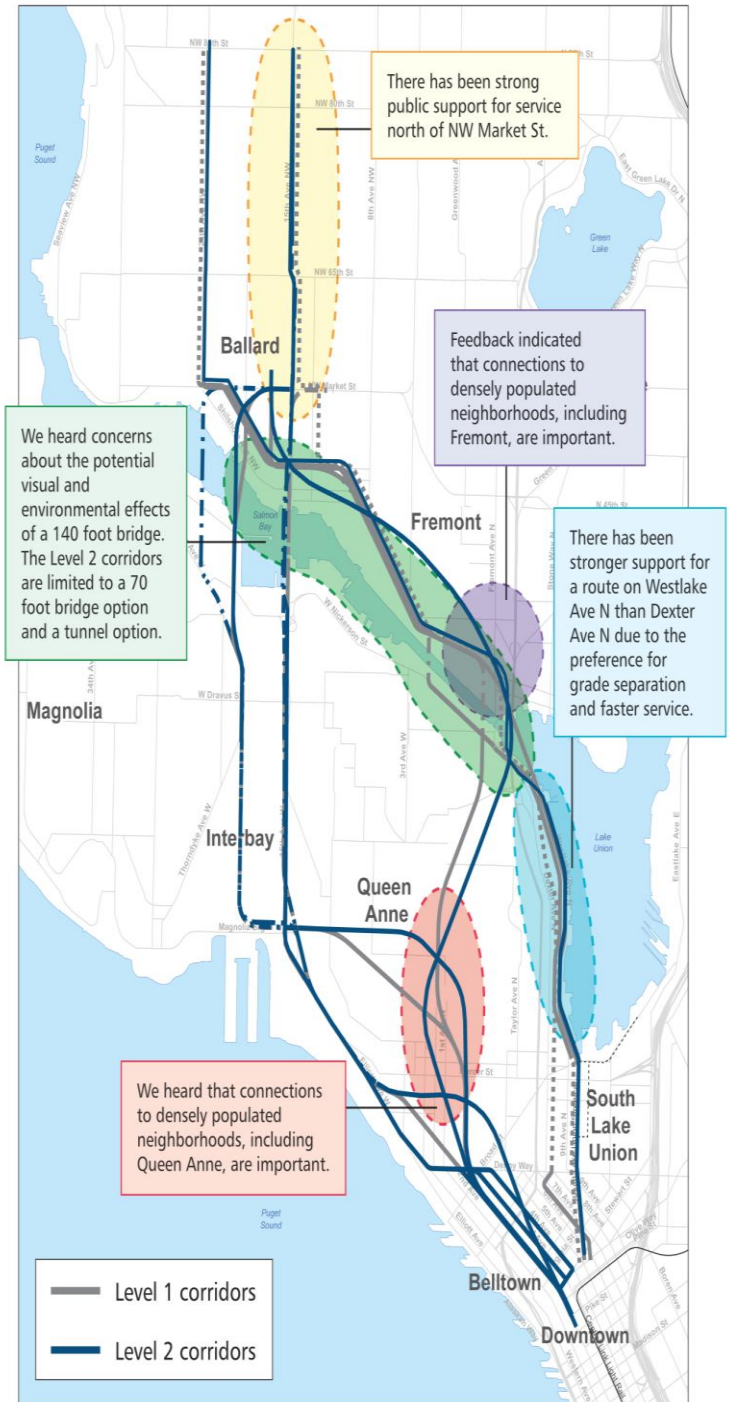
Ballard to Downtown Seattle

Transit Expansion Study

- Support implementation of the Seattle Transit Master Plan
- Support future ST Board discussions and Long-Range Planning on HCT options
- Study Modes: Link light rail & rapid Streetcar



Specific Feedback by Geographic Area



Study Process

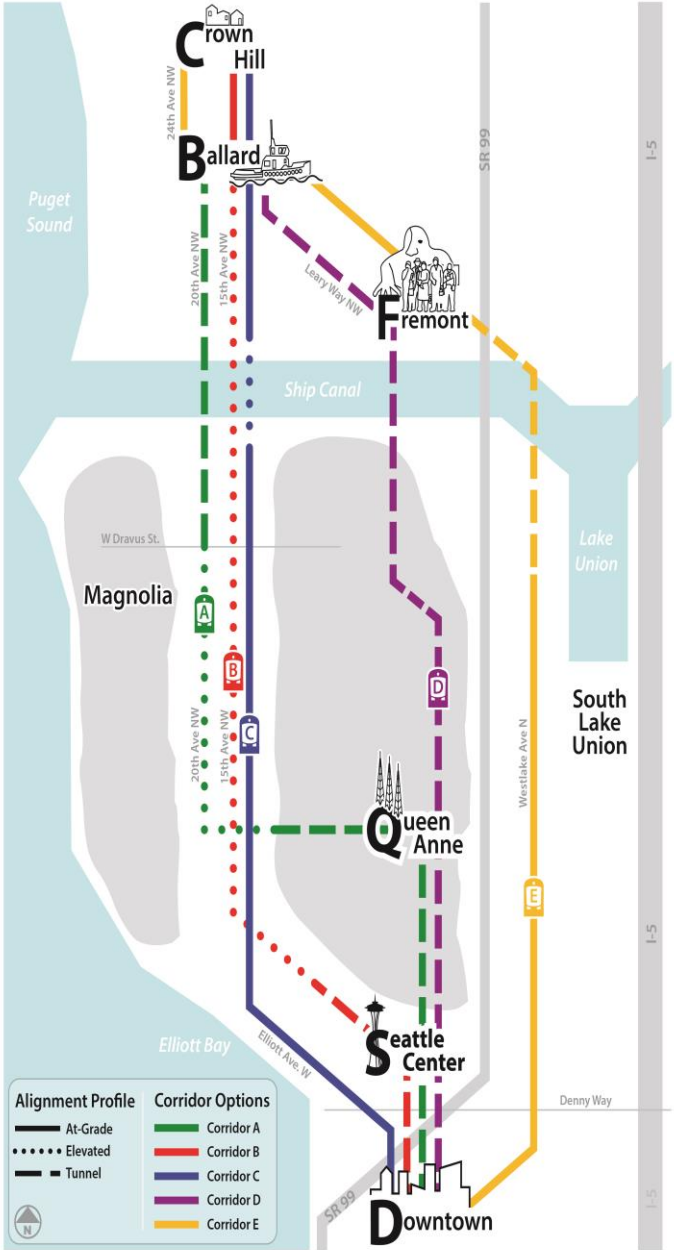
Start: Broad range of options gathered from outreach process and considered based on connections to key travel markets, impacts to traffic, and engineering feasibility

Level 1: 8 Corridors evaluated for conceptual-level capital costs, travel time, and engineering considerations

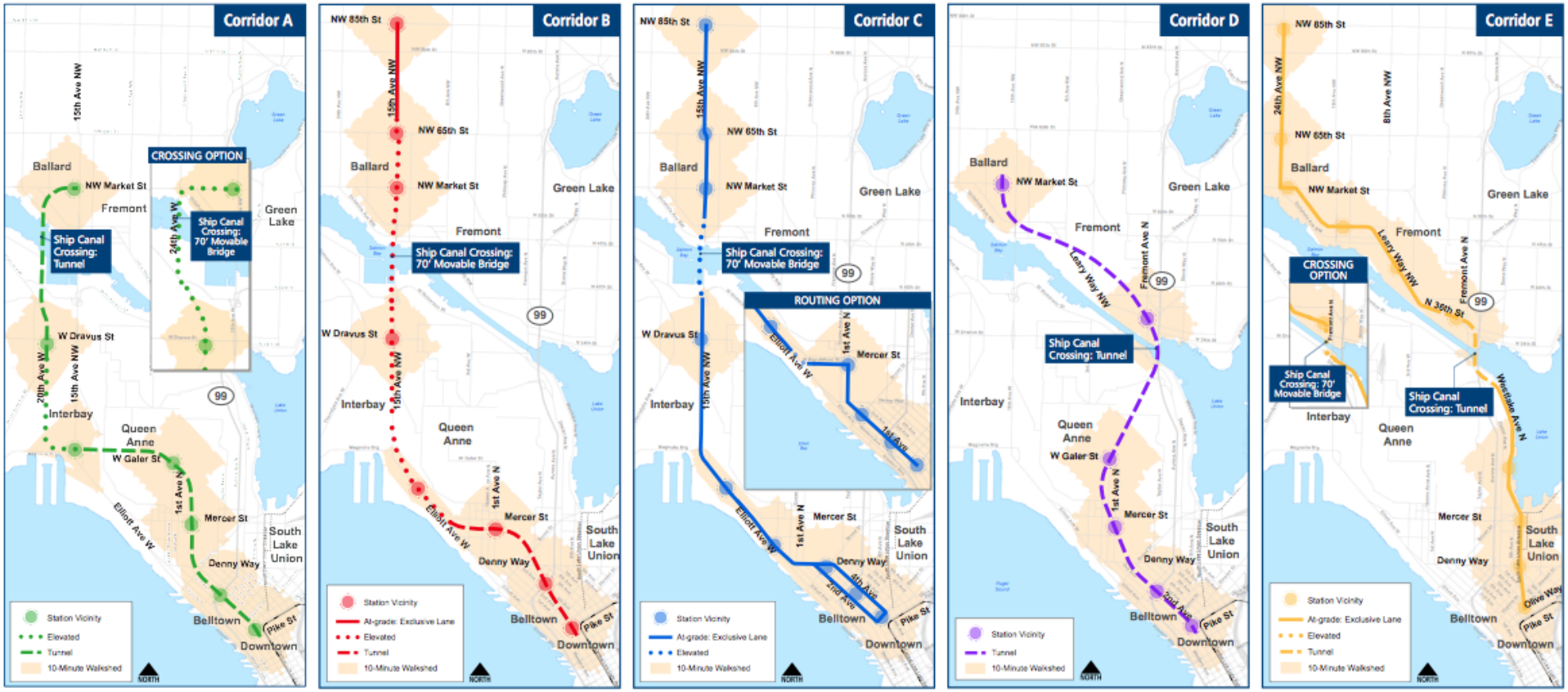
Level 2: Based on feedback from Level 1, five corridors were refined and evaluated for capital costs, travel time, and ridership. Results documented in final report.

Ballard to Downtown Seattle Transit Expansion Study

Level 2 Corridors



CORRIDORS IDENTIFIED IN THE LEVEL 2 ANALYSIS



Interbay West/Ship Canal Tunnel

Capital Cost (million)
Market St to Downtown Seattle: $3,200 - 3,600
With Crossing Option: $2,800 - 3,200

Peak Period Travel Time:
Market St to Downtown Seattle: 13 - 15 min

Daily Ridership
Market St to Downtown Seattle: 24,000 - 28,000

15th Avenue/Elevated

Capital Cost (million)
Market St to Downtown Seattle: $2,400 - 2,800
Extension to NW 85th St: + ~$150

Peak Period Travel Time:
Market St to Downtown Seattle: 11-13 min
Extension to NW 85th St: + 4 - 5 min

Daily Ridership
Market St to Downtown Seattle: 22,000 - 26,000
Extension to NW 85th St: + 5,000

15th Avenue/At-grade

Capital Cost (million)
Market St to Downtown Seattle: $800 - 1,200
With Routing Option: $800 - 1,200
Extension to NW 85th St: + ~$150

Peak Period Travel Time:
Market St to Downtown Seattle: 15 - 19 min
Extension to NW 85th St: + 4 - 5 min

Daily Ridership
Market St to Downtown Seattle: 14,000 - 18,000
Extension to NW 85th St: + 4,000

Queen Anne Tunnel

Capital Cost (million)
Market St to Downtown Seattle: $3,200 - 3,600

Peak Period Travel Time:
Market St to Downtown Seattle: 12 - 14 min

Daily Ridership
Market St to Downtown Seattle: 26,000 - 30,000

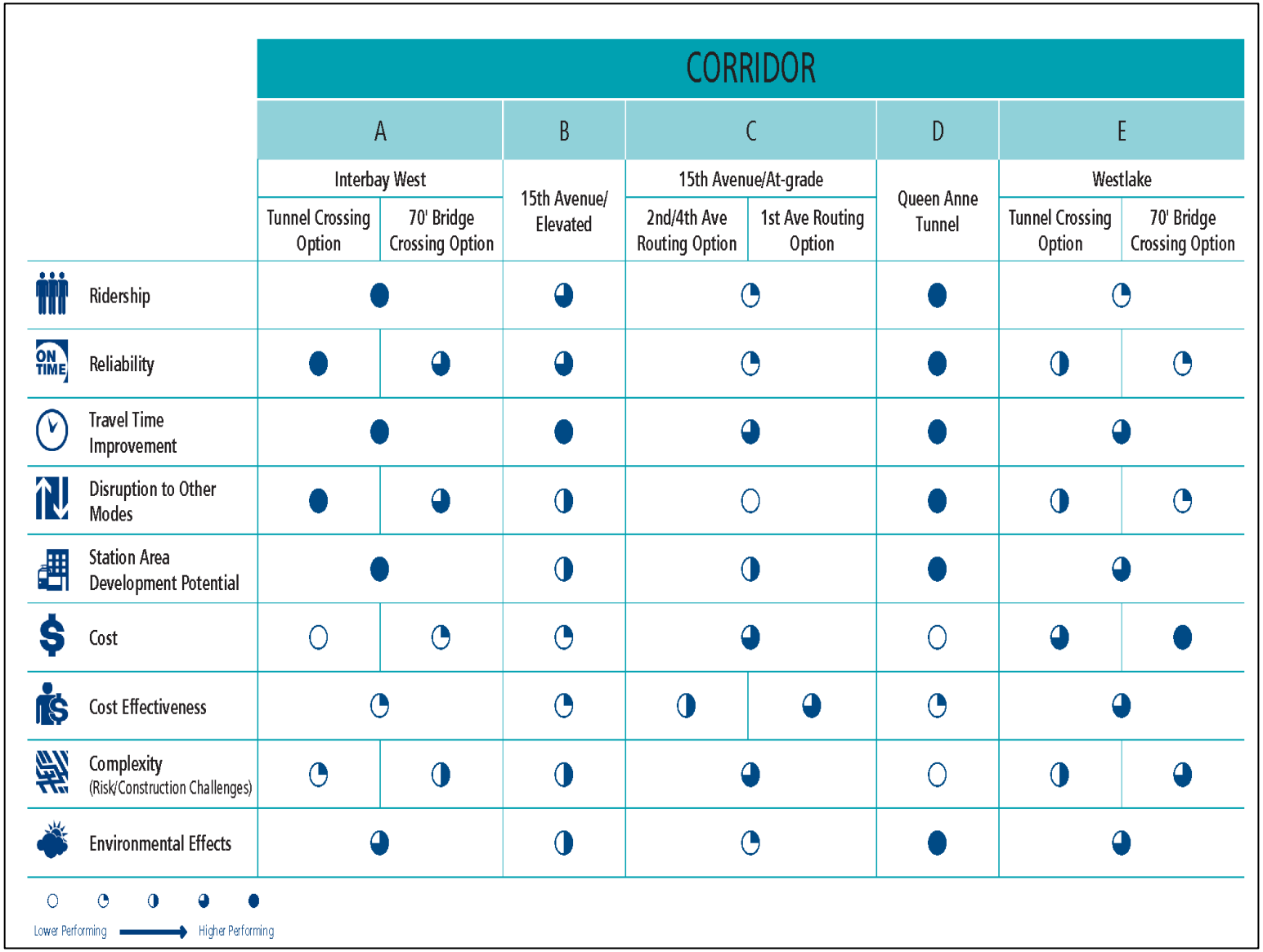
Westlake/Ship Canal Tunnel

Capital Cost (million)
Market St to Downtown Seattle: $800 - 1,200
With Crossing Option: $400 - 800
Extension to NW 85th St: + ~$100

Peak Period Travel Time:
Market St to Downtown Seattle: 17 - 21 min
Extension to NW 85th St: + 4 - 5 min

Daily Ridership
Market St to Downtown Seattle: 14,000 - 18,000
Extension to NW 85th St: + 2,000

Level 2 Corridor Evaluation



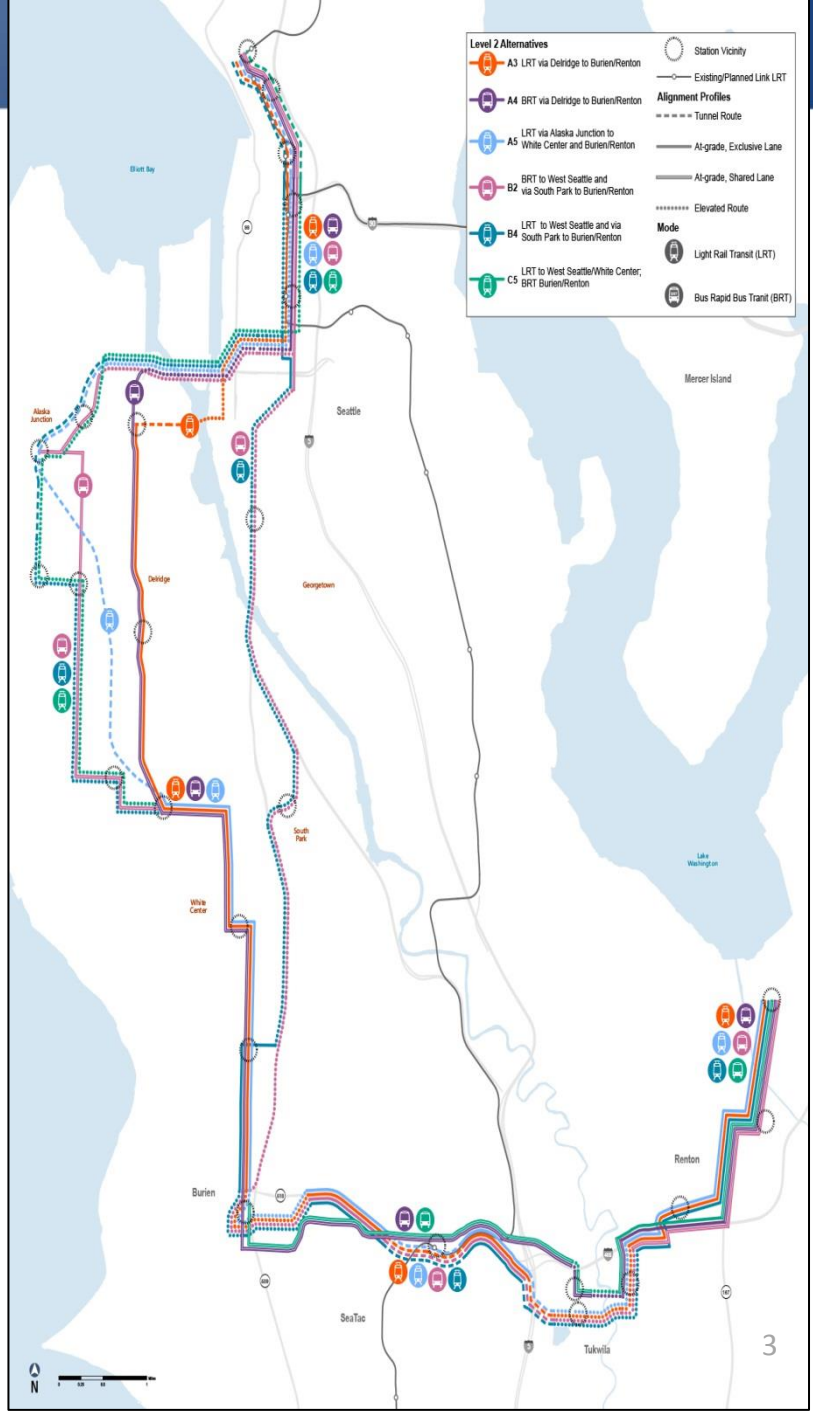
South King County HCT Corridor Study

Review of General Findings

SoundTransit

South King County HCT Corridor Alternatives

- A3 LRT via Delridge to Burien/Renton
- A4 BRT via Delridge to Burien/Renton
- A5 LRT via Alaska Junction to White Center and Burien/Renton
- B2 BRT to West Seattle and via South Park to Burien/Renton
- B4 LRT to West Seattle and via South Park to Burien/Renton
- C5 LRT to West Seattle/White Center, BRT between Burien and Renton



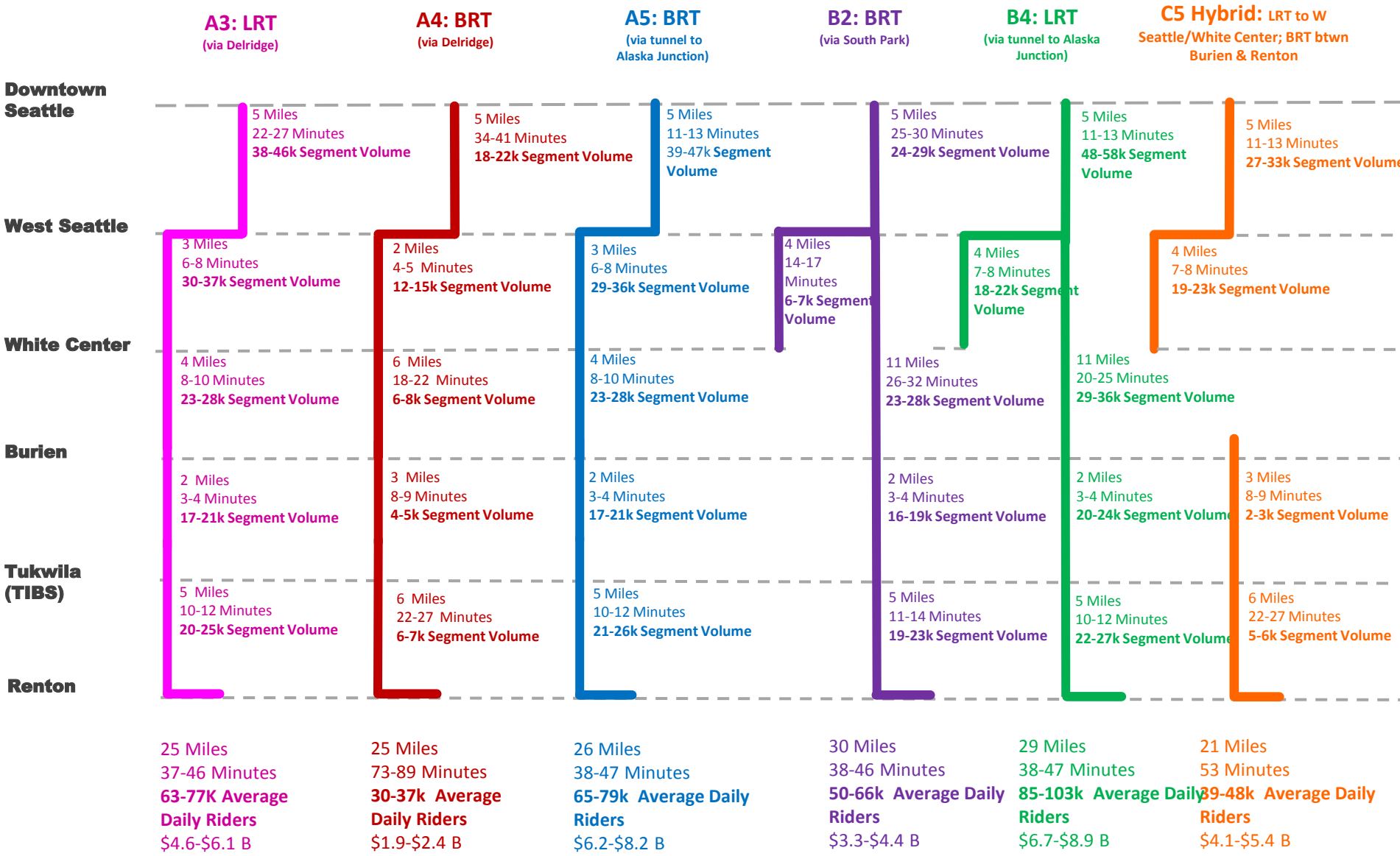
South King County HCT Corridor Study

General Findings

- Strong overall ridership within the corridor
- Market characteristics vary
- BRT demand is relatively high but can be difficult to serve with realistic bus headways
- High potential right-of-way impacts for the surface & elevated segments from West Seattle to Burien & in Renton because of existing development patterns
- No major natural environmental effects; some potential visual & noise issues
- High potential for equity issues given diverse population groups

South King County HCT Study Corridor

SOUNDTRANSIT RIDE THE WAVE



A3: LRT (via Delridge)	A4: BRT (via Delridge)	A5: BRT (via tunnel to Alaska Junction)	B2: BRT (via South Park)	B4: LRT (via tunnel to Alaska Junction)	C5 Hybrid: LRT to W Seattle/White Center; BRT btwn Burien & Renton
25 Miles	25 Miles	26 Miles	30 Miles	29 Miles	21 Miles
37-46 Minutes	73-89 Minutes	38-47 Minutes	38-46 Minutes	38-47 Minutes	53 Minutes
63-77K Average Daily Riders	**30-37k Average Daily Riders**	**65-79k Average Daily Riders**	**50-66k Average Daily Riders**	**85-103k Average Daily Riders**	**39-48k Average Daily Riders**
$4.6-$6.1 B	$1.9-$2.4 B	$6.2-$8.2 B	$3.3-$4.4 B	$6.7-$8.9 B	$4.1-$5.4 B

Level 2 Evaluation Results

Goal	Criteria	A3 LRT Delridge	A4 BRT Delridge	A5 LRT Tunnel White Center	B2 BRT White Center & Burien/Renton	B4 LRT Tunnel West Seattle	C5 LRT to White Center; Burien/Renton BRT
Provide a transportation system that facilitates long-term mobility	Rider Benefits						
	Reliability						
Enhance communities and protect the environment	Environmental Effects						
	Infrastructure						
Contribute to the region's economic vitality	Economic Development						
Strengthen communities' access to and use of the regional transit network	Regional Transit & Pedestrian/Bicycle Connections						
Develop a system that is financially feasible	Preliminary Design Cost Estimate						
	Cost Effectiveness						
	Complexity						

Lower Performing → Higher Performing

Federal Way to Tacoma HCT Study

Review of General Findings

South Corridor Alternatives Planning

Based on information as of 9/5/2014

SOUNDTRANSIT

Federal Way – Tacoma Corridor

- Approx. 10 miles between Federal Way Transit Center and Tacoma Dome Station along I-5 or SR 99.
- Connects the 2nd and 7th largest cities in the region, with areas of relatively low density in between (approx. 10% of district population).
- ST Express, King County Metro and Pierce Transit bus routes currently serve the corridor, with connections to Sounder commuter rail and Amtrak at TDS.

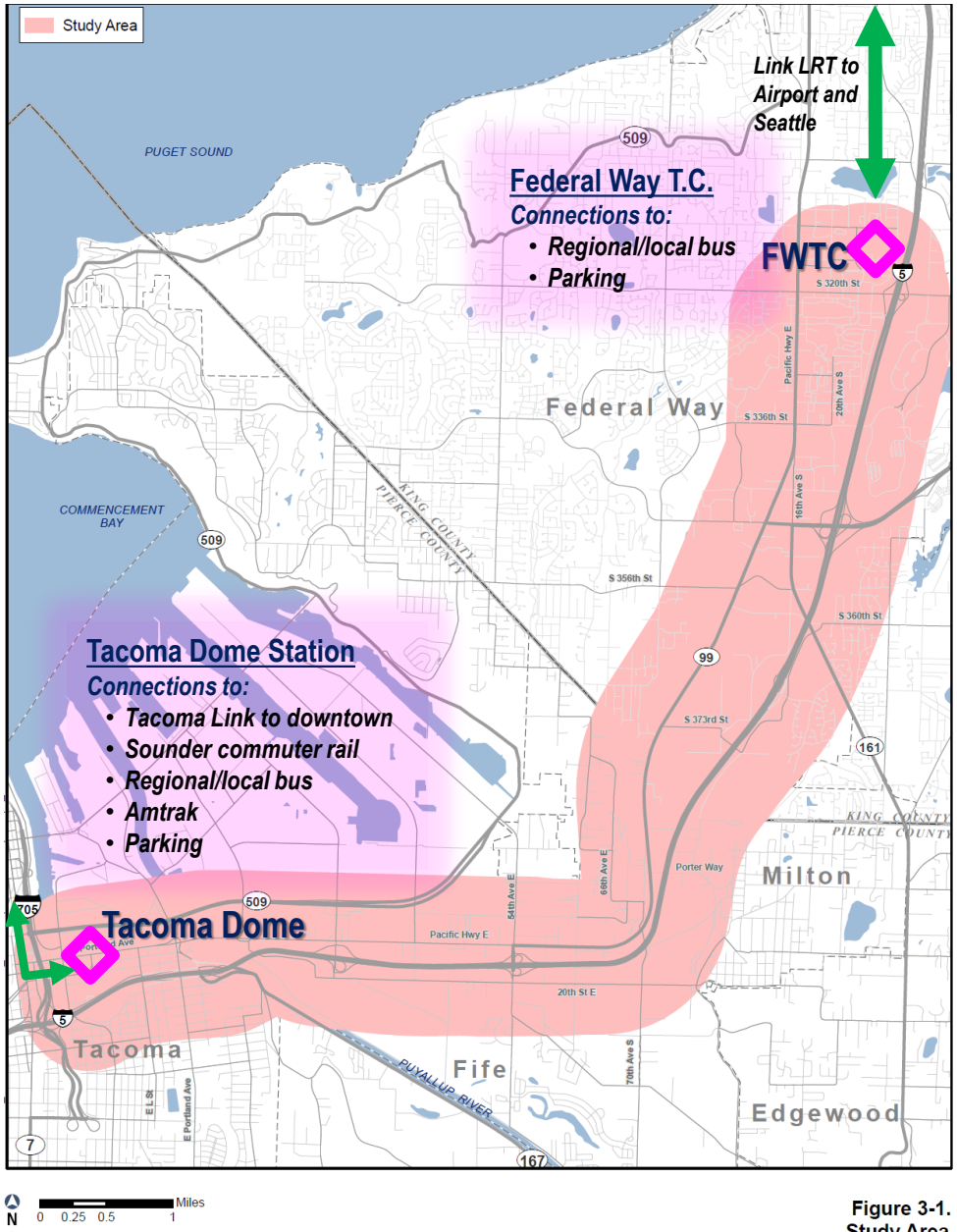


Figure 3-1.
Study Area

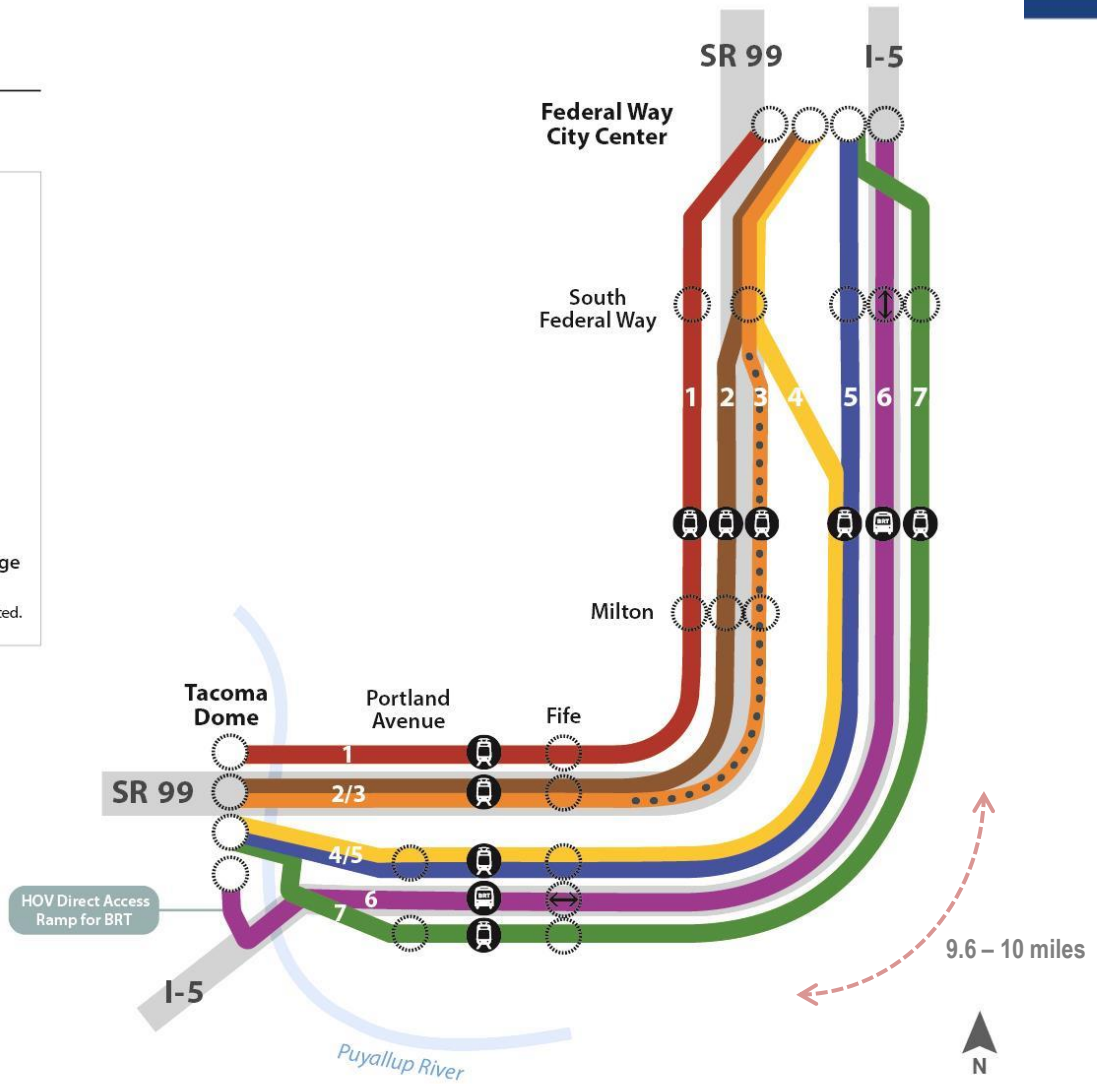
Federal Way to Tacoma HCT Corridor Study

Level 2 Options

- 1 SR 99 West LRT
- 2 SR 99 Center LRT
- 3 SR 99 Hybrid LRT
  - • • • • At-grade Section
- 4 SR 99 to I-5 LRT
- 5 I-5 West/North LRT
- 6 I-5 BRT
- 7 I-5 East/South LRT
- Highway

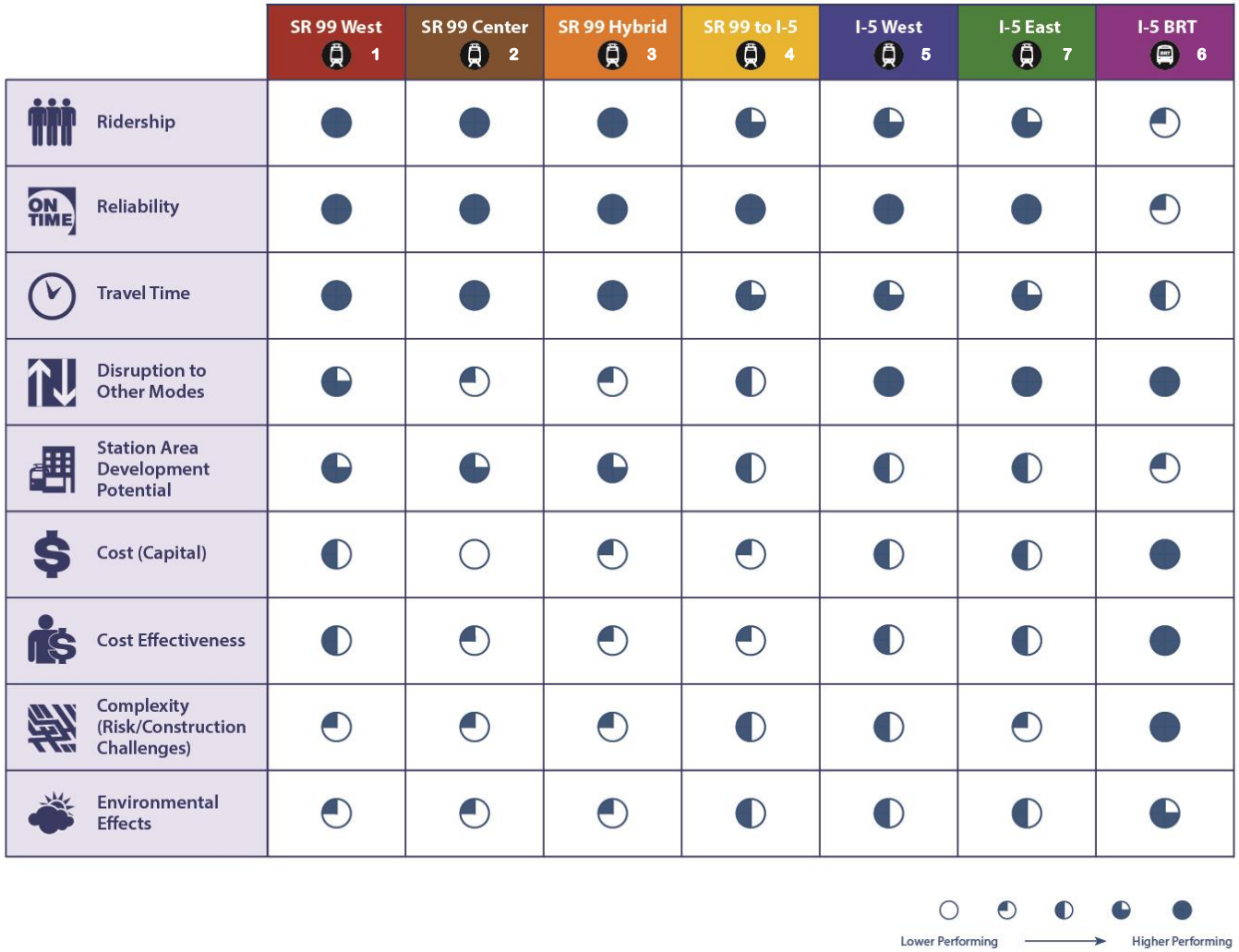
- Light Rail Station
- BRT Station and Flyer Stop or Direct Access Interchange

* All options are mostly elevated unless otherwise noted.



Level 2 Options Map

Federal Way to Tacoma HCT Study



Level 2 Evaluation Results

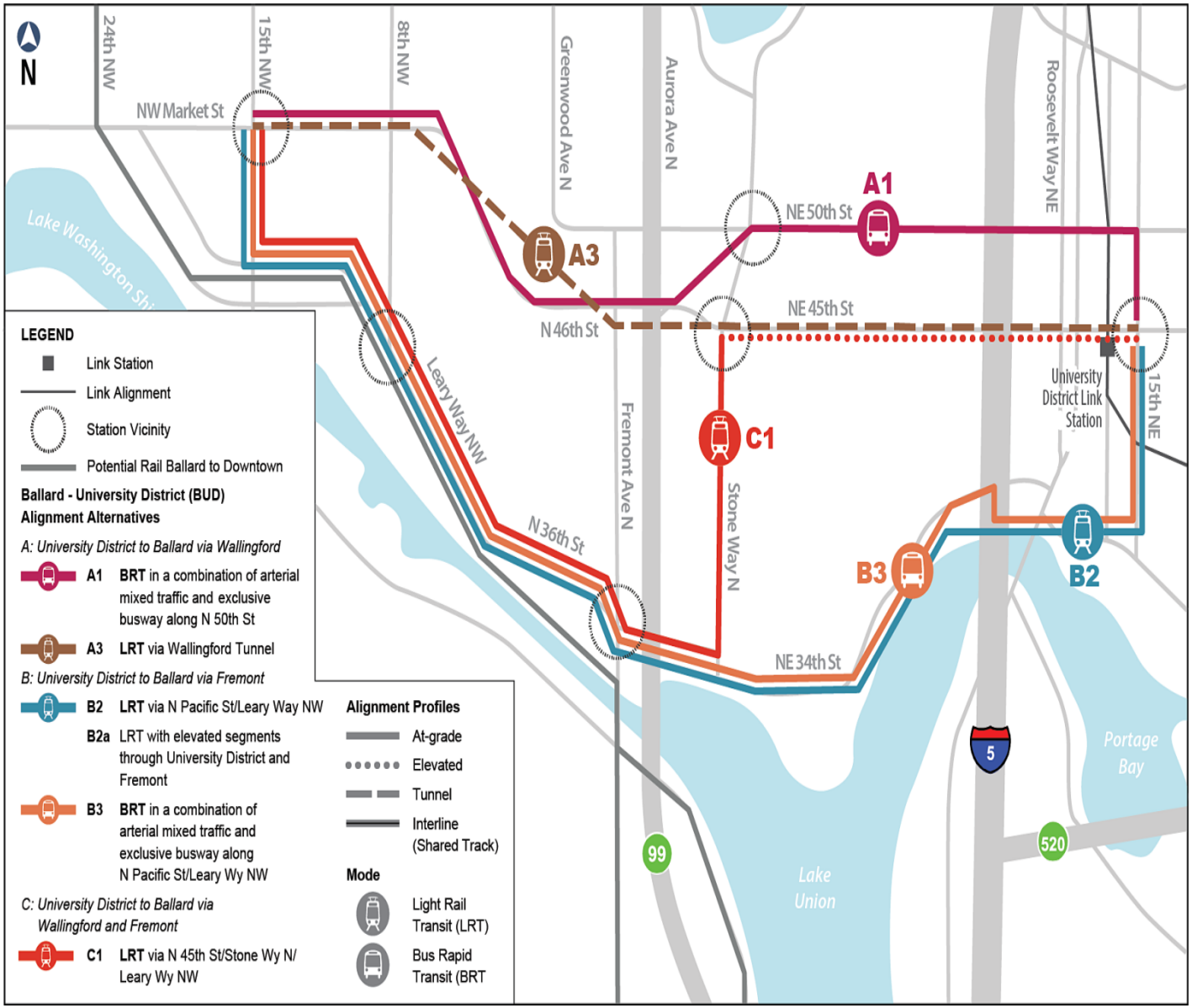
Federal Way to Tacoma HCT Study

Central and East HCT Corridor Studies

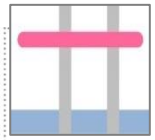
Review of General Findings

SOUNDTRANSIT RIDE THE WAVE

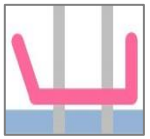
Level 2 Alternatives – Geographic Map



Ballard to the U District

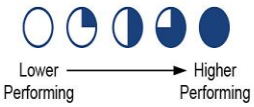


U District – Wallingford– Ballard



U District – Fremont – Ballard

U District – Wallingford– Fremont – Ballard



GOAL	PERFORMANCE MEASURES	BRT in a combination of mixed traffic and exclusive busway along N 50th St	LRT via Wallingford tunnel	LRT via N Pacific St and Leary Wy NW	LRT with elevated segments through University District andFremont	BRT in mixed traffic and exclusive busway along N Pacific St and Leary Wy NW	LRT via N 45th St, Stone Wy N, and Leary Wy NW
Provide a transportation system that facilitates long-term mobility	Travel Market Potential	18 to 22 minutes 14k to 17k riders per day	6 to 9 minutes 22k to 26k riders per day	10 to 13 minutes 20k to 24k riders per day	10 to 12 minutes 21k to 26k riders per day	14 to 19 minutes 10k to 12k riders per day	9 to 11 minutes 23k to 28k riders per day
	Reliability						
Enhance communities and protect the environment	Environmental Effects						
	Existing Transportation System						
Contribute to the region's economic viability	Development Potential						
Strengthen communities' access to and use of the regional transit network	Regional Connectivity						
Develop a system that is financially feasible	Preliminary Design Cost Estimate	$159 mil - $206 mil	$1,396 mil - $1,879 mil	$1,215 mil - $1,641 mil	$1,163 mil - $1,572 mil	$286 mil - $387 mil	$1,238 mil - $1,672 mil
	Complexity						
	Cost Effectiveness						

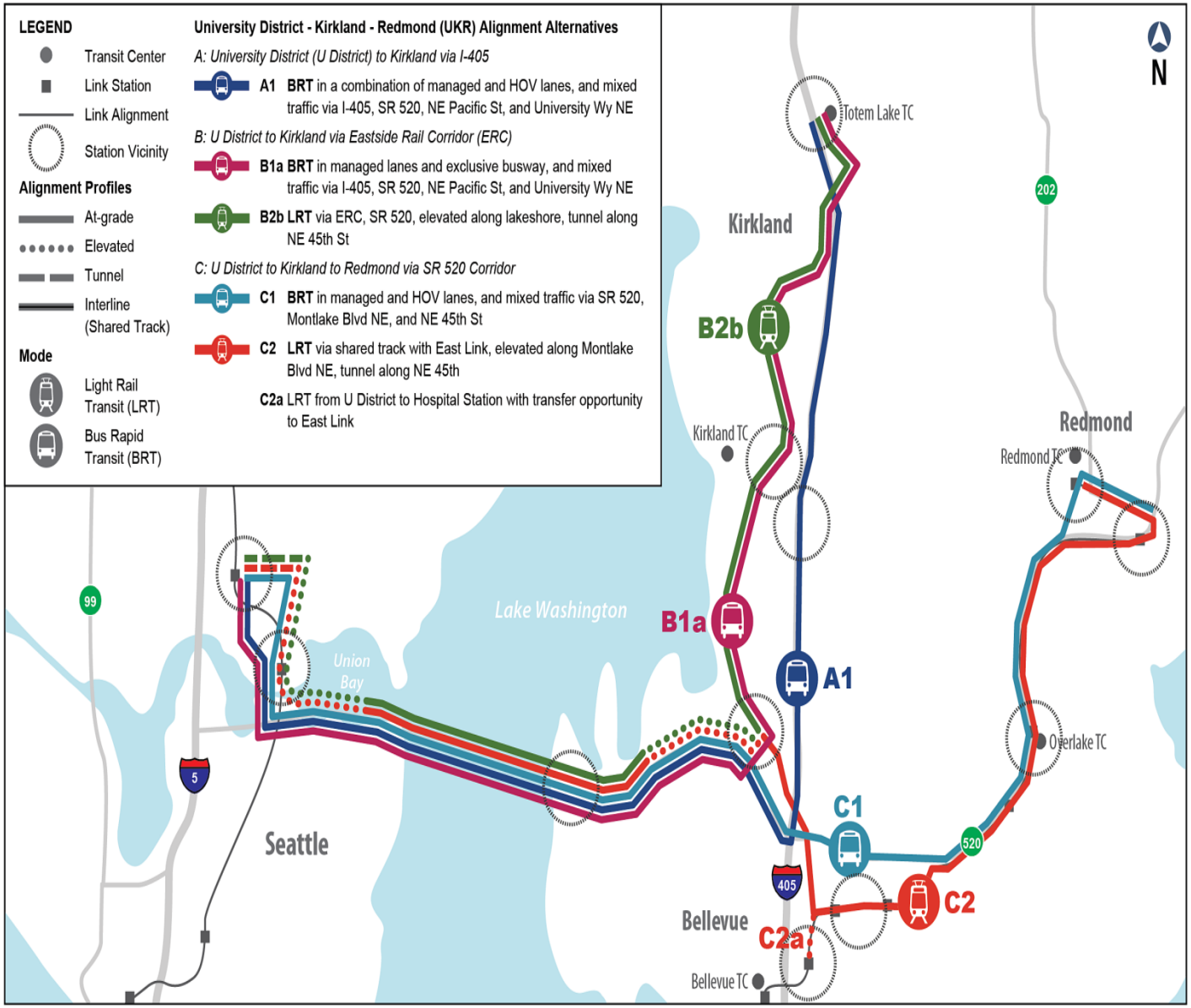
Note:
Cost estimates are conceptual and for comparative purposes only, calculated in 2014 $.

General Findings

- Above ground options trade off reliability and speed for traffic and ROW impacts
- Tunnels achieve reliability with limited impacts, but are costly
- Options that serve both Fremont and Wallingford have slightly stronger ridership potential than options that serve just one neighborhood

SOUNDTRANSIT RIDE THE WAVE

Level 2 Alternatives – Geographic Map



U District – Kirkland – Redmond

Lower Performing → Higher Performing

GOAL	PERFORMANCE MEASURES	U District - Kirkland via I-405	U District - Kirkland via Eastside Rail Corridor (ERC)		U District - Kirkland - Redmond via SR 520		
		 **BRT** in managed and HOV lanes and mixed traffic via I-405, SR 520, NE Pacific St, and University Wy NE	 **BRT** in managed lanes, exclusive busway, and mixed traffic via ERC, SR 520, NE Pacific St, and University Wy NE	 **LRT** via ERC, SR 520, elevated along lakeshore, tunnel along NE 45th St	 **BRT** in managed lanes, HOV lanes, and mixed traffic via SR 520, Montlake Blvd NE, and NE 45th St	 **LRT** via East Link, elevated on Montlake Blvd NE, tunnel along NE 45th St	 **LRT** from U District to Hospital Station with transfer opportunity to East Link
Provide a transportation system that facilitates long-term mobility	Travel Market Potential	18 to 23 minutes 7k to 9k riders per day	19 to 24 minutes 7k to 9k riders per day	18 to 23 minutes 7k to 9k riders per day	33 to 40 minutes (potential reliability issues) 10k to 13k riders per day	25 to 31 minutes 18k to 22k riders per day	15 to 19 minutes 9k to 11k riders per day
	Reliability	*	*		*		
Enhance communities and protect the environment	Environmental Effects						
	Existing Transportation System						
Contribute to the region's economic viability	Development Potential						
Strengthen communities' access to and use of the regional transit network	Regional Connectivity						
Develop a system that is financially feasible	Preliminary Design Cost Estimate	$340 mil – $460 mil	$180 mil – $240 mil	$2,110 mil – $2,860 mil	$50 mil – $60 mil	$1,880 mil – $2,540 mil	$1,930 mil – $2,610 mil
	Complexity						
	Cost Effectiveness						

Note:
Cost estimates are conceptual and for comparative purposes only, calculated in 2014 $.

*Reliability assumes operation of WSDOT managed lanes at 45MPH

General Findings

- Serving the U District is highly complex with potential impacts to:
  - ST agreement with UW
  - Vibration sensitive research facilities at UW
  - Historic properties
  - Tribal burial ground
  - Recreational and wetland resources
  - Major utility lines
  - Viewsheds

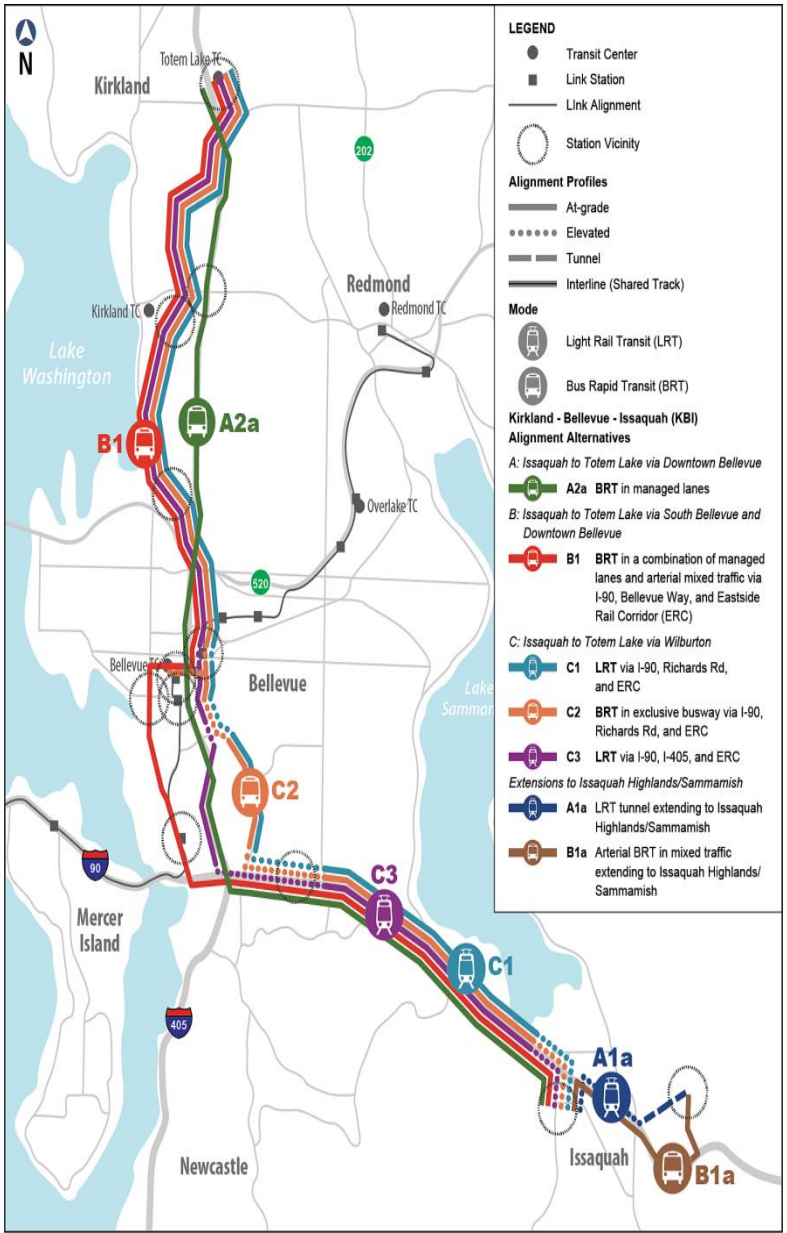
- Expanding the SR 520 floating bridge deck improves reliability and travel time but is profoundly costly, complex and impactful

- BRT options rely on WSDOT to operate managed lanes on SR 520 and I-405 at 45MPH

- A new HCT corridor across Lake Washington may impact cross-lake travel patterns including East Link ridership

SOUNDTRANSIT RIDE THE WAVE

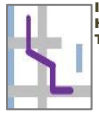
Level 2 Alternatives – Geographic Map



Kirkland – Bellevue – Issaquah


Issaquah – Bellevue TC – Totem Lake


Issaquah – South Bellevue – Bellevue TC – Totem Lake


Issaquah – Hospital Station – Totem Lake


Design Options Extending to Issaquah Highlands

Lower Performing → Higher Performing

GOAL	PERFORMANCE MEASURES	BRT in managed lanes	BRT in managed lanes, exclusive busway, and mixed traffic via I-90, Bellevue Wy, and ERC	BRT in managed lanes and mixed traffic via I-90, Bellevue Wy, and I-405	LRT via I-90, Richards Rd, and ERC	BRT in managed lanes, exclusive busway, and mixed traffic via I-90, Richards Rd, and ERC	LRT via I-90, I-405, and ERC	LRT tunnel	BRT in mixed traffic
Provide a transportation system that facilitates long-term mobility	Travel Market Potential	23 to 28 minutes 6k to 7k riders per day	28 to 34 minutes 9k to 11k riders per day	26 to 32 minutes 6k to 8k riders per day	23 to 28 minutes 9k to 11k riders per day	23 to 28 minutes 7k to 8k riders per day	22 to 27 minutes 9k to 11k riders per day	26 to 31 minutes 11k to 13k riders per day (extension adds 2k riders per day)	33 to 40 minutes 11k to 13k riders per day (extension adds 2k riders per day)
	Reliability	*	*	*		*			
Enhance communities and protect the environment	Environmental Effects								
	Existing Transportation System								
Contribute to the region's economic viability	Development Potential								
Strengthen communities' access to and use of the regional transit network	Regional Connectivity								
	Preliminary Design Cost Estimate	$540 mil - $710 mil	$730 mil - $970 mil	$540 mil - $710 mil	$1,960 mil - $2,670 mil	$1,170 mil - $1,570 mil	$1,940 mil - $2,620 mil	$2,410 mil - $3,280 mil (adds $450 mil - $610 mil)	$760 mil - $1,010 mil (adds $30 mil – $40 mil)
Develop a system that is financially feasible	Complexity								
	Cost Effectiveness								

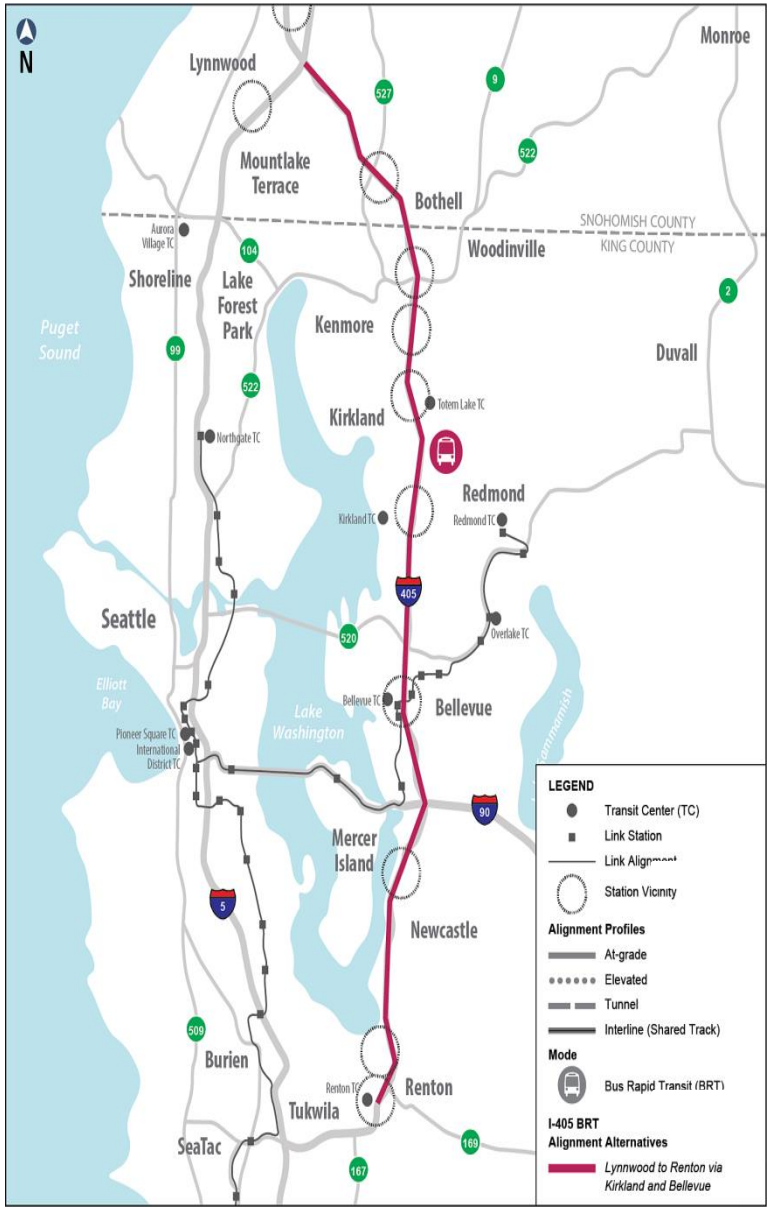
Note:
Cost estimates are conceptual and for comparative purposes only, calculated in 2014 $.

*Reliability assumes operation of WSDOT managed lanes at 45MPH

General Findings

- Options that serve South Bellevue Station and Bellevue Transit Center provide strong access to Downtown Bellevue and Downtown Seattle
- Design options to the Issaquah Highlands trade off reliability and speed for cost and complexity
- BRT options rely on WSDOT to operate managed lanes on I-90 and I-405 at 45MPH

I-405 Bus Rapid Transit



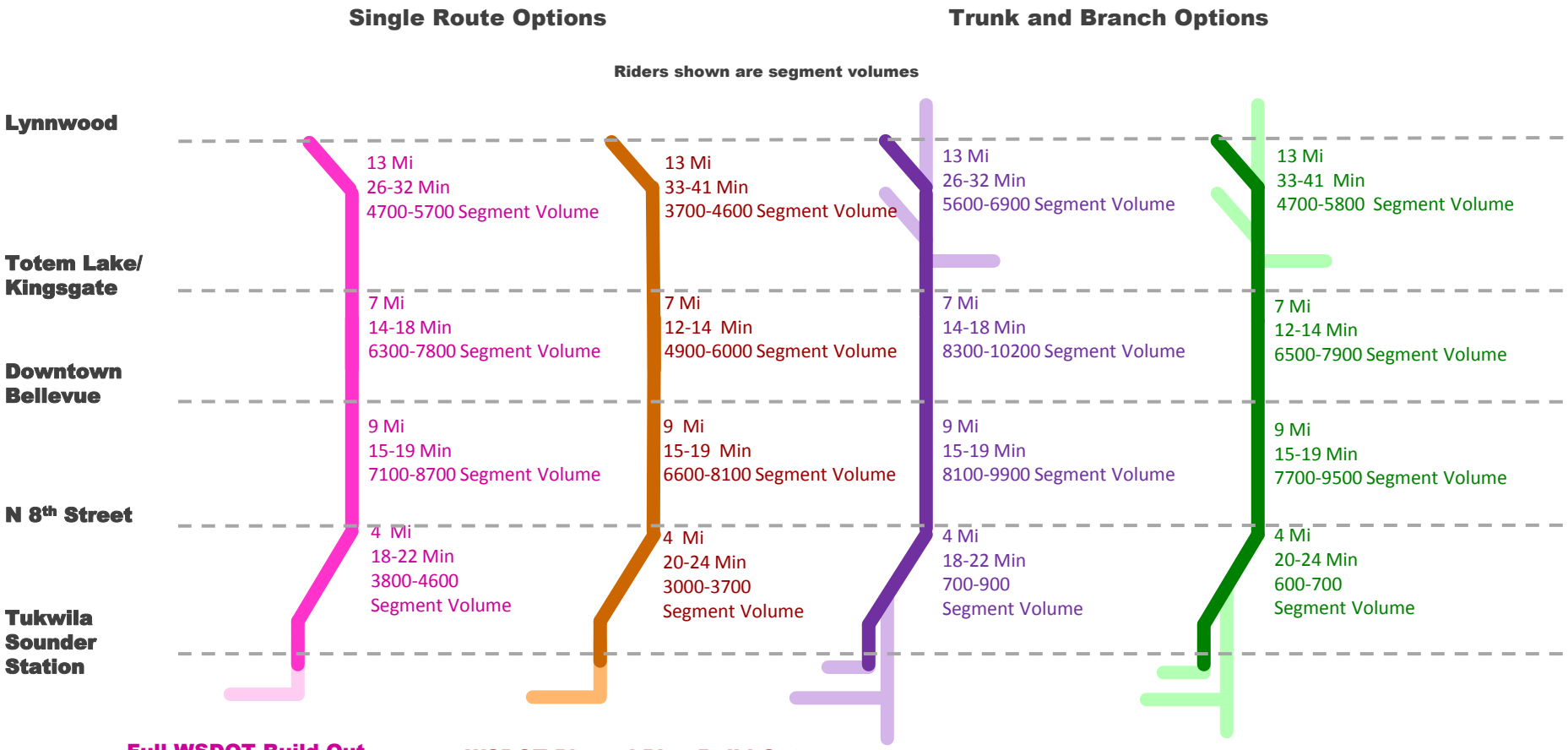
With full build out of WSDOT I-405 Master Plan

- Single route BRT
- Trunk and branch BRT

With WSDOT I-405 Master Plan Phased Plan

- Single route BRT
- Trunk and Branch BRT

Alternatives Compared



Full WSDOT Build Out
33 Mi
73-91 Min
17000-21000 Daily Riders
Capital Cost: $1280-$1670M
O&M Cost: $24M/Year

WSDOT Phased Plan Build Out
33 Mi
80-98 Min
14000-17000 Daily Riders
Capital Cost: $680-$920M
O&M Cost: $23M/Year

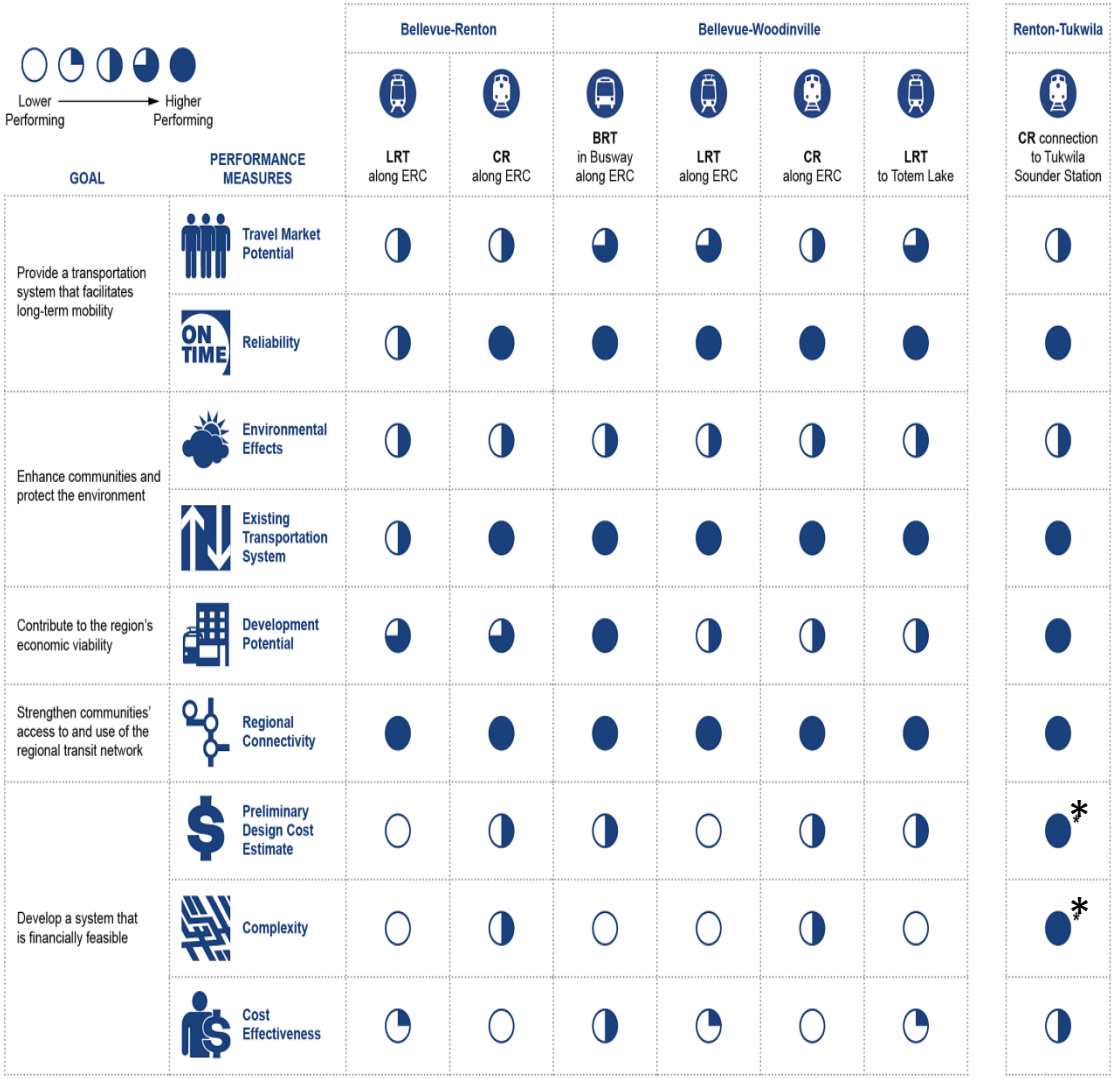
Full WSDOT Build Out
33 Mi
73-91 Min
20000-25000 Daily Riders
Capital Cost: $1280-$1670M
O&M Cost: $44M/Year

WSDOT Phased Plan Build Out
33 Mi
80-98 Min
17000-20000 Daily Riders
Capital Cost: $680-$920M
O&M Cost: $40M/Year

General Findings

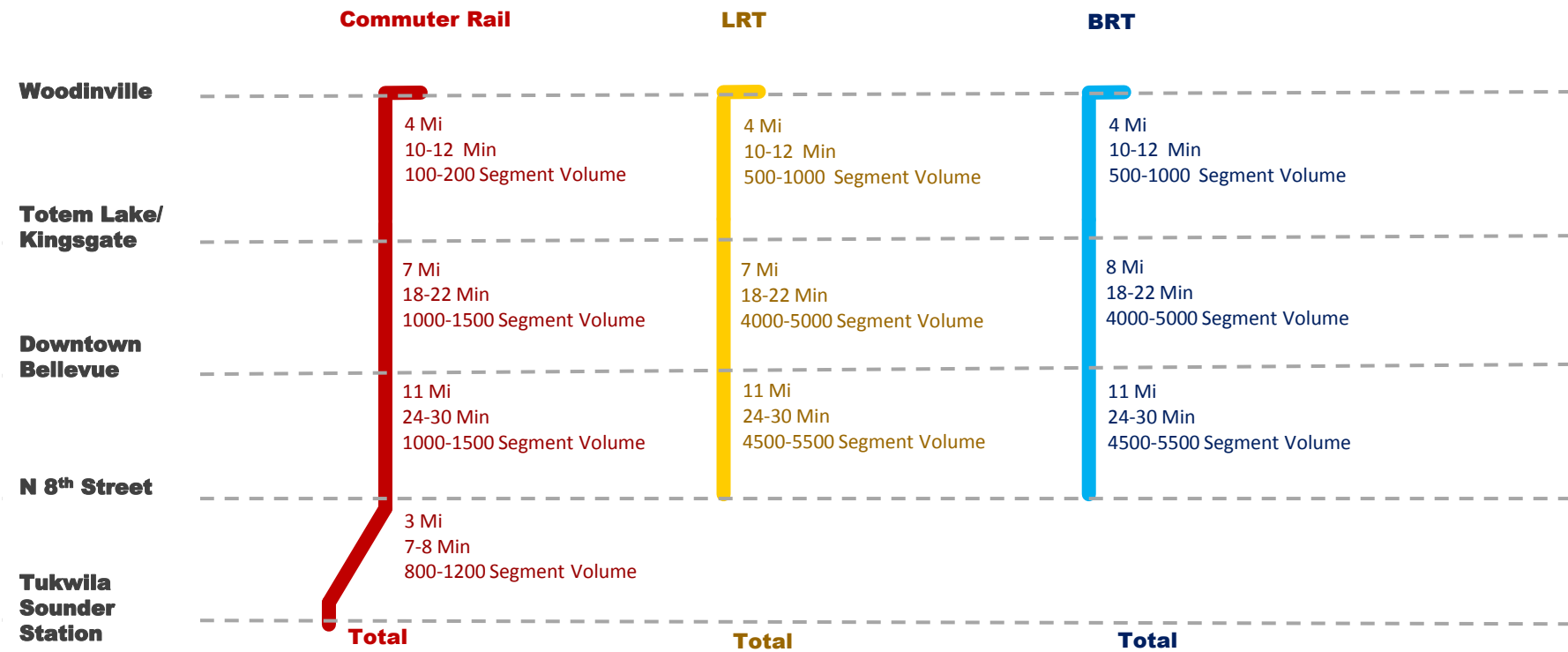
- Moderate ridership across all options
- No exclusive ROW
- Reliance on WSDOT implementation of I-405 Master Plan elements and 45 MPH operation of Express Toll Lanes
- Strong access to activity centers and development potential, especially in Bellevue and Renton
- Cost to operate trunk and branch service substantially higher than single route service due to increased bus platform hours

Level 2 Evaluation results



* Does not include cost or complexity of acquiring BNSF easements

Alternatives Compared



Total
25 Mi
60-72 Min
3500-5000 Daily Riders
$1200-$1570M
O&M Cost: $71M/Year

Total
22 Mi
52-64 Min
9000-11000 Daily Riders
$1980-$2640M
O&M Cost: $24M/Year

With Totem Lake terminus:
19 Mi
42-52 Min
8500-10500 Daily Boardings
$1670-$2220M
O&M Cost: $26M/Year

Total
23 Mi
52-64 Min
9000-11000 Daily Riders
$1070-$1440M
O&M Cost: $17M/Year

General Findings

- Limited ridership across corridor – strongest south of Totem Lake, maximized with shorter headways
- Strong reliability across modes due to exclusive ROW
- Moderate connectivity and development potential – more opportunities from Bellevue north
- Constrained ROW and possible encroachments increase potential impacts
- Trail/utility relocation increases cost and complexity
- Commuter rail less expensive and complex to build, but more costly to operate than BRT or LRT

Overall HCT Corridor Study Findings

- Identified high ridership corridors on the spine—Lynnwood to Everett
- Identified some high demand areas off the spine—Ballard to downtown Seattle to West Seattle
- Identified some very complex areas, for example—between SR 520 and the University District
- Confirmed that exclusive guideways provide reliability and increase ridership
- Tunnels achieve reliability with limited impacts but high costs
- Above ground options trade off reliability and speed with traffic and ROW impacts
- Expanding the SR 520 bridge deck to accommodate light rail is profoundly costly, complex and impactful
- BRT options rely on operation of managed lanes on SR 520 and I-405 to operate at 45 mph